PRACTICAL EMULSIONS

A Handbook of Emulsions, Emulsifiers and Methods of Formulating and Making Emulsions of Practical Value in Industry

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PREFACE

ALTHOUGH there are many excellent books on colloid chemistry, which deal with emulsions in a theoretical and general manner, there is none which specifically deals with emulsions for the practical worker. This book, therefore, attempts to touch only lightly on the theoretical aspects and concentrates on the art of making and applying emulsions. No attempt has been made to compile a complete record of all published work on emulsions. The attempt has been rather to give sufficiently diverse examples to illustrate the advances in this field.

Because of certain desirable properties, emulsions are used in many varied fields. A few examples are wax and oil emulsions used as polishes; soluble oils in metal cutting; fat-liquors in leather processing; oil emulsions in textile treatment; agricultural sprays, water-paints, food, medicinal products, and so forth.

The greatest drawback to the increased use of emulsions is the lack of a proper understanding of the technique and formulation that is necessary to produce a good emulsion. While most formulations in this field have been obtained by "rule-of-thumb" methods, they are predicated on innumerable experiments and have withstood the test of long usage.

The purpose of this book is to set forth this practical information, within small compass, thus making it readily available to technical workers, who it is hoped, will find it helpful.

H. BENNETT.

INTRODUCTION

ALTHOUGH emulsions are finding newer and wider applications each day, basically they are not new. In 1674 a paper was read before the Royal Society, describing experiments whereby oils, resins and gums were incorporated in vinous and aqueous media.[1]

An emulsion, for practical purposes, is a dispersion of small drops of one liquid in another liquid, each of which is insoluble in the other. Pure mutually insoluble liquids will not usually emulsify. Consequently, certain natural impurities or the addition of a third material (called the emulsifying agent) is necessary to effect emulsification.

A colloidal solution is a dispersion of one phase in another as definite grains, globules, bubbles, filaments or films where the latter have at least one dimension of 5–200 millimicrons. While many emulsions are colloidal, others containing large globules are not.

Dispersed particles, less than 3 microns in diameter, exhibit a continuous, rapid, oscillating motion when observed through a suitable microscope, a phenomenon known as Brownian movement.

Hardy, Langmuir and Harkins developed the idea of the disposition of an emulsifying agent at the interface of two

[1] Chemist and Druggist, *132,* 475 (1940).

immiscible liquids. In the dineric interface the molecules are arranged regularly rather than haphazardly so that similar groups face each other. Thus, the organic radical of the emulsifier orients itself toward the organic phase (oil, solvent or wax) whereas the active or polar groups turn toward the aqueous phase. In an organic material having polar groups there is a great affinity for water with a resultant lower surface tension and a tendency toward increased miscibility. The following are examples of polar groups: CN, COOH, COOM, COOR, NH_2, $NHCH_3$, NCS, COR, CHO, OH, NO_2, Cl, Br, I and groups having N, S, O, and double bonds. (M=metal; R=radical).

This knowledge induced the synthesis of thousands of compounds, of varying degrees of complexity, which act as emulsifying agents. New emulsifying agents are being created each day as research develops new chemical compounds.

The hydrodynamics of emulsification, *i.e.*, the mechanical forces used to produce emulsions, is exceedingly complex and is not thoroughly understood. Since these forces are applied most un-uniformly it can be readily seen that such variables will give variable results. It is exceedingly important, in attempting to duplicate known emulsions, that all forces be duplicated as closely as possible.

The mechanics of emulsification concerns itself with two opposing tendencies.[2] The globules are broken down in size by impact and shearing forces. These tend to form unstable laminae or cylinders which in turn tend to coalesce. These tendencies are affected, to varying degrees, by interfacial tension, volume ratio, viscosity and density of the phases.

When mechanical forces are weak, interfacial tension plays an important part. When stresses are high, as in an homo-

[2] Stamm, J., Phys. Chem., *30*, 996 (1930).

genizer, interfacial tension plays only a minor role. In either case, it may have considerable influence in globule coalescence where the disperse phase has a great volume. During the emulsification and after the emulsion has been formed, coalescence takes place.

A usual prerequisite for emulsification is adsorption in one phase and solution in the other, the interface being composed of the emulsifier.[3] The interface generally consists of more than one layer of molecules.[4]

There are many theories on emulsions and each has its adherents. Until the disputants can agree, there is not much point in discussing the merits of each theory.

[3] Freundlich, et al., Technical Aspects of Emulsions, Chemical Publishing Co., Inc. (1936).
[4] McBain, J., Amer. Chem. Soc., *49*, 2230 (1927) ; *51*, 3534 (1939).

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Part I
GENERAL

Linseed extract for margarine [10] and bituminous emulsions.[11] Humates for bituminous emulsions,[12] tannic acid [13] or rubber latex [14] for bituminous emulsions. Lecithin for margarine [15] and bitumen emulsion.[16] Pectin [17] for emulsions of insecticidal and edible oils as well as egg yolk.[18]

An emulsifying agent need not necessarily lower surface tension (e.g., Saponin) but it must form a protective film around each globule.[19]

The controlling factor, determining the type of dynamic dispersion, is the relative volume of oil and water. The internal pressure of liquids probably controls the effect of volume ratio. The dispersion type can usually be predicted from the relation between internal pressure and surface tension of pure liquids. Systems containing less than 25% water usually form water-in-oil dispersions, while systems containing more than 31% water usually form oil-in-water dispersions. In extreme cases, systems containing less than 10% water form water-in-oil dispersions, systems containing more than 45% water form oil-in-water dipersions, and systems containing 10–45% water may form either type. Between 10 and 45% water content, the factors that exert the chief effect in determining the type of dispersion are the relative specific gravities, viscosities and dielectric constants of the oil and water, the pH of the water, and the effects of emulsifying

[10] Blichfeldt, Brit. 104,899 (1916).
[11] Schutte, U. S. 1,950,272 (1934).
[12] I. G., Brit. 369,242 (1930); I. G., Brit. 334,426 (1928); I. G., Brit. 317,496 (1928); Ges. F. T., Ger. 591,340 (1934).
[13] Levy, Brit. 246,907 (1924).
[14] Coles, Brit. 329,965 (1929); Coles, U. S. 1,886,334 (1932).
[15] Behrend, Brit. 405,116 (1933); Bollman, Brit. 369,990 (1930).
[16] Muhlenwerke, Brit. 383,432 (1931).
[17] Deiglmayr, Ger. 585,586; 575,922 (1934); Calif., Fr. Gr. Ex. Brit. 369,518 (1930); Patterson, U. S. 1,726,364 (1929); Douglas, Brit. 221,466.
[18] Bergsvik, U. S. 1,941,243 (1933); Hellerud, U. S. 1,941,261 (1933). Brit. 341,414 (1929); Heide, Brit. 357,246 (1930).
[19] Hillyer, Z., physik. Chem. *47,* 336 (1904).

agents. In a relatively narrow transition zone, the character and intensity of agitation determine the type of dispersion. Less important and often negligible factors are the shape and size of the container, total volume of the liquids, preferential wetting ability of the container walls, surface-tension, differential and the interfacial tension. The relations between dispersion and emulsification were investigated with crude oil and brine, which form stable water-in-oil emulsions. The dispersion characteristics of the system coincide with the general characteristics of dispersions, they are independent of the method of emulsification. dependence but apparently control it to a considerable extent. Intermittent agitation is 20 times more efficient than continuous agitation because it suppresses the dispersion of oil in water. The limiting concentration of stable emulsions is approximately 50% with excess brine and continuous agitation, and 75% with intermittent agitation and addition of the brine in increments.[1]

The power of any emulsifying agent and dispersion factor can be calculated from comparison of quantities of undispersed phase and unused dispersion medium in identical emulsions.[2]

Emulsifiers have been classified as products of C, H, and O; C, H, O, and S; C, H, O, and N; and are rated by their effect in emulsions.[2a]

An electrical charge on the oil phase particles, formed by adsorption of OH (from water) ions, may substitute the emulsifying agent.[3]

The particle size of ion stabilized emulsions is about 0.4 microns regardless of method of preparation.[4]

The emulsifying power of sodium stearate and sodium

[1] Rottseig, J., Phys. Chem. (U.S.S.R.) *9,* 35 (1937).
[2] Smith, J., Soc. Chem. Ind. *46,* 345 (1937).
[2a] Gallo, Boll. chim. farm. *77,* 517 (1938).
[3] Thomas, Jol. Ind. & Eng. Chem. *12,* 177 (1920).
[4] Lewis, Kolloid-Z-*4,* 211 (1909).

palmitate [5] has been compared by determination of the smallest quantity of soap necessary to emulsify equal volumes of different oils. The purity of the soaps was very important. The final volume of soap solution and oil used for each emulsion was 100 cc. The curves (weight of soap in grams with cc. of oil) of cottonseed and poppy-seed oils were similar, as were those of mustard-seed, sesame, olive and coconut oils. With each increase of 10 cc. of oil the amount of soap increased, although this increase was not in direct proportion, i.e., the emulsifying power of the soap increased with increase in concentration. In general, the emulsifying power of sodium palmitate was greater than that of sodium stearate. The soap solution with the lower surface tension possessed the greater emulsifying power.

The sodium, potassium and ethanolamine soaps prepared from purified naphthenic acid [6] are appreciably less alkaline in reaction than other soaps; their aqueous solutions, even in high concentrations, do not tend to gel; and they are excellent emulsifying agents.

Oil-in-water emulsions [7] are given by sodium oleate, arabic acid; arabates of sodium, magnesium and iron; valerates of ammonium and sodium; sodium glyconate, galactonate, dihydroxystearate, salicylate and gallate. Water-in-oil emulsions are given by ursolic acid,[6a] oleates of magnesium, calcium, cobalt (ous); magnesium and aluminum; magnesium and zinc valerates or dihydroxystearate. Lead arabate does not serve, and the following substances give both types: calcium gluconate, cadmium galactonate, calcium salicylate and gallate. In emulsions of vegetable or mineral oil with acacia,

[5] Jajnix Kolloid-Z-*37*, 139 (1925); White, J., Phys. Chem. *24*, 617 (1920).

[6] Minich, Textile Colorist, *60*, 698 (1938).

[7] Krantz, Colloid Symposium Monograph 6, 173 (1928).

[6a] Carleton, The Chemist, *18*, 453 (1941).

the greatest stability exists when the pH of the external phase is between 2 and 10. With tragacanth, the pH range is 1.9 to 2.3. Greatest stability for acacia is at a pH of 4.11 to 4.28; for tragacanth, about 2.5. Particle size, surface tension, interfacial tension and viscosity were determined at various pH. Particle size and viscosity in tragacanth emulsions are affected by pH but not in acacia emulsions. However particle size increased in the latter with pH over 7.

Olive oil gives a more stable emulsion with magnesium oleate than does mineral oil, the most stable emulsion range being pH 11–12.5, with an extremely unstable range at pH 2.5. Surface tension of water-in-oil emulsions is unaffected by pH changes of the internal phase; unstable emulsions have a lower viscosity than stable ones; particle-size variations, up to 30 microns average, do not alter stability.

The active emulsifiers of lanolin and lanolin alcohols [8] have been represented as "hydroxycholesterol" and "metacholesterol". Both of these are mixtures of sterols and are only partially precipitated by digitonin. The active principle of these mixtures is cholesterol and its emulsifying power is somewhat increased by the presence of fatty alcohols in the unsaponified portion of wool fat. Pure isocholesterol has no emulsifying properties. The removal of isocholesterol from lanolin alcohols, increases their emulsifying power. The emulsifying action of hexadecanol is superior to hexacosanol. β Cholestanol is slightly inferior to cholesterol. Pure cholestandiol has poor emulsifying power even when mixed with cholesterol. α Hydroxycholesterol, β hydroxycholesterol and cholestanolon have good emulsion properties. Cholestantriol has no emulsifying properties. Of the zoosterols, coprosterol is as good as dihydrocholesterol, of which it is an isomer. In

[8] Janistyn, Fette U. Seifen *47,* 351 (1940); Lifsohvetz, Ber. *29,* 2890; Roemer, J. Amer. Phar. Assoc. *1,* 673.

general, sterols precipitated by digitonin have emulsifying properties.

Experiments were conducted on the emulsification power of some fatty alcohol-solvents combinations [9] to determine (1) the number of cc. of oil which can be held in emulsion by 1 cc. of the aqueous solutions and (2) the "half-value" time at which half the emulsion had been separated. In these experiments, which were conducted at room temperature, 0.2% solutions and consistent amounts of solvent were taken. The emulsification period was 5 minutes. Fresh textile preparations were used and 0.2 cc. of oil was added at a time. Results: Using a soap solution, soap solvent, Turkey-red oil solution, fatty alcohol product and a fatty alcohol solvent combination of the chlorinated hydrocarbon type, the amounts of petroleum emulsified were, respectively, 2.2, 3.2, 4.0, 6.3 and 8.2 cc.; the half-value times for petroleum were 20, 18, 25, 30 and 28 minutes; the olive oil emulsified was 3.2, 4.2, 3.8, 5.9 and 6.4 cc.; and the half-value times for olive oil were 60, 68, 75, 30 and 25 minutes. Other tests were made under the same experimental conditions to determine the time in which 0.2 g. of oil or fat could be emulsified, yielding an emulsion which was stable for 10 minutes. Using the fatty alcohol-solvent combination of the halogenated hydrocarbon type the last tests yielded a period of 10–12 minutes for bone fat, 15–20 minutes for mineral oils and 18–30 minutes for linseed oils.

Sulfonated (or sulfated) oils of many kinds are very useful as emulsifiers.[10] They vary greatly in their effects because they vary in themselves. Not only do the raw material oils vary in chemical composition but when they are sulfo-

[9] Ohl, Spinner U. Weber *52,* No. 49, 9 (1934).
[10] Sulphated Oils—Burton (1940) Chemical Publishing Co., Brooklyn, N. Y.

nated, the finished products will vary with the concentration of sulfuric acid used, the time, temperature, water content, washing and neutralizing methods, and other related factors.

These sulfonated oils are effective in weakly acid media. They tend to separate out water, hydrolyze on ageing, and split off acid which in turn will react with certain metals with which they come in contact.

In spite of all these disadvantages, sulfonated oils are used in tremendous quantities because they possess certain advantages and are low in price.

They must, however, be bought from reputable houses who standardize their products so that comparable results can be gotten from all shipments.

Analysis of these products is recommended to avoid production difficulties.

The oil most frequently sulfonated is castor. For special purposes nearly all commercial, vegetable, animal and fish oils are used. Some sulfonated oils dissolve clearly in water while others do not. The latter class is preferred in fat-liquoring of leather.

Ruemele [11] gives ways of determining the efficiency of the emulsifying power of sulfonated oils.

Sulfonated hydrogenated castor oil is superior to commercial sulfonated castor oil as an emulsifying agent for certain products; a good 25% oil emulsion is produced with 1.25% of the former while an emulsion with 10% of the latter breaks. Sulfonated hydrogenated castor oil is likewise preferred to commercial sulfonated castor oil for production of cosmetics. A stable cold cream is readily prepared with 0.035% of sulfonated hydrogenated castor oil as the sole emulsifying agent;

[11] Ruemele, Seifens-Z-62, 393 (1935).

and paraffin oil-water. A similar study was made of egg yolk on the system benzene-water, at 15°. Bile and egg yolk proved to be strong emulsifiers, and in the case of bile, the greater the difference in polarity of the two nonmiscible liquids, the greater its action.

By the interaction of borax and fatty acid, whether cerotic or stearic acid,[18] the resulting sodium soap usually causes an oil-in-water emulsion. When 25 per cent water, 14.5 per cent white wax, about 60 per cent liquid paraffin and not over one per cent borax is used, a water-in-oil emulsion forms, which becomes less stable as the borax content approaches one per cent. The change of phases is not dependent on the white wax; it takes place in precisely the same manner with a mixture of paraffin hydrocarbons.

The antagonistic effect among emulsifiers which individually produce the same type of emulsion, i.e., oil-in-water emulsions or water-in-oil emulsions, often breaks such emulsions, when the emulsifiers are mixed. In the preparation of emulsions of pure Norwegian cod-liver oil for pharmaceutical purposes several interesting cases of antagonism of emulsifiers were observed. Both bile salts and gum acacia, when present alone, produce stable emulsions; but when present together no emulsion forms. With Turkey-red oil, lecithin and sodium oleate, it was found that when mixed with gum acacia, the emulsion formed liberates oil slowly at the top, although when gum acacia is present alone no such separation is observed. Gum acacia, when mixed with gelatin, egg albumin, saponin, Irish moss, agar-agar or gum tragacanth instead of causing liberation of oil, stabilizes the emulsion. Emulsifiers can be classified into 3 groups: (1) emulsifiers with low internal and superficial viscosity like sodium oleate; (2) emulsifiers with low internal and high superficial viscosity

[18] Bushby, Pharm. J. *135,* 345 (1935).

like saponin; and (3) emulsifiers with high internal and superficial viscosity like gum acacia. A general conclusion is drawn from the experimental study, that emulsifiers of group (1) antagonize the other groups and cause liberation of the oil at the top. Emulsifiers of groups (2) and (3) do not have mutual antagonistic action. If, however, a large amount of gum acacia is used with group (3) emulsifiers, the emulsions lose consistency, become thin and water quickly separates at the bottom.[18a]

Emulsifiers especially applicable to pharmaceutical use:

a. Acacia is the most commonly used emulsifying agent for oil-in-water emulsions. Acacia and other gums should not be used in emulsions intended for external application, as they leave a sticky layer on the surface of the body.
b. Tragacanth is next in importance to acacia but is not as soluble in cold water. If used in conjunction with other good emulsifiers, it produces the viscosity necessary to stabilize the emulsion.
c. Agar absorbs considerable quantities of water and in this respect is similar to tragacanth. It is useful when combined with acacia and must be used in solution and kept warm until the emulsion is completed, as agar gels at about 40°C.
d. Gelatin should not be combined with other emulsifying agents. Gelatin solutions are used to some extent for making liquid petrolatum emulsions.
e. Chondrus mucilage prepared from chondrus is seldom used, except in large-scale operations, because of the time required for preparing it.
f. Egg yolk is a natural emulsion and may be used in preparing artificial emulsions.

[1] Chatterjee, J. Indian Chem. Soc. *13*, 563 (1936).

g. Soap is an excellent emulsifying agent but is not generally used for preparing emulsions for internal use on account of its laxative action and unpleasant taste. Lime liniment (carron oil) is a water-in-oil emulsion in which the soap formed by the action of the lime water on linseed oil, is the emulsifying agent.
h. Alkalies are frequently listed as emulsifying agents but they act by saponifying fats and oils, producing soaps which are the actual emulsifiers.[18b]

Pectin produces coarse emulsions of apricot kernel, cod liver and mineral oils and is not a satisfactory emulsifying agent when used alone. When one-half of the acacia is replaced by a small amount of pectin, the emulsion produced is satisfactory, even though microscopic examination shows the globules to be somewhat larger than those produced by acacia alone.[18c].

Frothing and Protective Action.

Saponin lowers the surface tension [19] of aqueous solutions, being itself concentrated at the interface. This is the cause of the very marked frothing of such solutions when shaken with air. The film of concentrated saponin solution which encloses the bubbles is characterized by a considerable amount of rigidity which accounts for the great stability of the foam, but this is destroyed by the presence of surface-active substances such as alcohol or ether, which displace the saponin from the film.

The extreme dilution at which this frothing may be observed varies with the different saponins, and may be used to characterise them and also as a means of assay of saponin-

[18b] Methods for Pharmacy Technicians, p. 117, U. S. War Dept. 1941.
[18c] Goldner, J. Amer. Pharm. Ass'n. 114, *44*, (1942).
[19] The Saponins. G. Middleton, Ind. Chem. Pharm. & Cosmetic supplement May 1935.

containing drugs. The "Foam value"[20] of a number of samples of senega root has been found to vary from 1,000 to 3,300; that of sarsaparilla root from less than 40 up to 660. There does not appear to be any relation between the foam values and the haemolytic index.

The concentration of saponin at the interface also occurs when the second phase is a liquid, e.g., an oil, so that saponins form useful emulsifiers. They have an advantage over soaps and other compounds of a salt-like nature, in that their emulsifying power is not appreciably affected by the alkalinity or acidity of the solution within the limits usually employed.

Hydrotropic Solvents

Compounds of the type RSO_3M; where M is sodium, potassium, calcium, lithium, or an ammonium group; R is a long chain paraffin or aromatic group; are hydrotropic solvents.

A concentrated water solution (40% or more) dissolves many water insoluble materials. In some cases, emulsions first form and often may be cleared by the judicious addition of water.

Some hydrotropic solvents are:

Sodium Kerosene Sulfonate
Calcium Xylene Sulfonate
Calcium Lignin Sulfonate

These have been used in making emulsions and solutions of cellulose acetate, pyroxylin, nitrobenzol, methylsalicylate, anethol, essential and perfume oils.

[20] Kofler, Pharm. Monat. *3*, 117 (1922).

CHAPTER II

TYPES OF EMULSIONS AND FOAMS

Emulsion Types

EMULSION may be oil in water (O/W), water in oil (W/O) or dual emulsions. An O/W emulsion is one whose continuous (outside) phase is aqueous. A W/O emulsion is one whose continuous (outside) phase is oily or water insoluble. A dual type of emulsion is made up of a mixture of the above two types of emulsions.

A number of methods are available for determining the type of emulsion.

Since an emulsion can only be diluted with the continuous phase, it is added to a little water. If it spreads and mixes with the water, it is O/W; if not it is W/O.

If a little oil soluble dye is dusted on the surface of an emulsion, the latter will only be colored if oil is the continuous phase (W/O). If it is not colored, then it is O/W. This of course, presupposes that the dye powder does not invert the emulsion.[1]

If two electrodes are introduced into an emulsion and a current applied, little or no current will flow (as indicated by galvanometer)[2] if the oil phase is continuous. If a flow of current is shown, then the water phase is continuous and the emulsion is O/W.

[1] The Elements of Colloidal Chemistry, Freundlich, London, Eng.
[2] Pullar, Chemist & Druggist, *127,* 742 (1937).

A parallel bundle of light rays, going through a droplet of O/W emulsion will be converged; through a W/O emulsion it will be diverged.[3]

W/O type emulsions, usually form when the ratio of water to oil is low (less than 1). The addition of more water often reverses the emulsion.

Where a W/O type is desired the water should be added to the oil. For an O/W type the oil should be added to the water. This procedure does not imply that the desired type will always form, only that with all factors equal, it will be inducive to a certain type formation.

Hydrophilic[4] emulsifiers (such as gum arabic, gelatin or soap)[5] tend to form oil in water emulsions. Hydrophobic emulsifiers (such as metallic soap) tend to form water in oil emulsions. Emulsifiers which have both hydrophilic and hydrophobic position may produce either type. Where one of the phases has a greater affinity for the emulsifier it tends to become the dispersion medium, for then the droplets of the disperse phase can build up a protective sheath from the emulsifier.[6]

Thus, if an oil is shaken with a dilute soap solution, an O/W type results because the soap is soluble in the continuous and not in the disperse phase. If a little calcium oleate is dissolved in the oil (with warming) and water is then mixed in, a W/O emulsion results.

In W/O emulsions, if the oil is lighter than water, it will cream downward; if more dense, upwards. In O/W emulsions creaming directions are the opposite.

The term "dual emulsion" is applied to emulsions of the same pair of liquids, with the same emulsifier, in opposite

[3] Carriere, Chem. Weekblad *26*, 413 (1929).
[4] W. Meyer, Farben-Chemiker *5*, 157 (1939).
[5] Elements of Colloidal Chemistry, Freundlich.
[6] Wellman, J. Phys. Chem. *34*, 379 (1930).

types. A dual emulsion is usually made by changing the phase volume ratio. In some cases it is formed by mechanical action. There is also the possibility of chemical reaction between the emulsifier and one or both phases, producing a different emulsifier which tends toward inversion and in certain cases toward duality. Thus, the chemical and physical character of the components is just as important as the kind of emulsifier used. For example, if the only variation in a given system is in the nature of the oil phase the same or different type of emulsion will be formed with varying stability. Thus, while gelatin usually gives O/W emulsions with most oils, with cresol it forms W/O.

Dual type emulsions may be formed by purely physical changes. A protein emulsifier may hydrolyze or be denatured; one of the phases may cause a change in pH; a colloid may assume different states of aggregation and so on.

Partition of the emulsifier between two phases may also produce dual type emulsions. Thus, where an emulsifier is soluble in both phases, the change in amount of either phase will change the specific partition of the emulsifier.

Lecithin dispersions form dual type emulsions with benzene, carbon tetrachloride, chloroform, cresol, hexalin, linseed oil, phenol, and light petroleum. It is quite likely that the partition of the emulsifier, between both phases, is responsible for the duality. Then again, it may be due to the presence of impurities like cephalin.

Hevea lipin also forms dual type emulsions as do proteins and similar substances, such as peptone, albumin, casein and gelatin. Here the emulsifier may form protein complexes with resultant duality of type.

In the system acetic acid, benzene and water, there are three regions, one in which oil-in-water type emulsions result, another in which water-in-oil type emulsions result and an intermediate region in which the type depends on the

method of shaking. Foam forms in an oil-in-water type emulsion.

The results of Cheesman[7] throw doubt on the rule that a given emulsifying agent is capable of stabilizing an emulsion of one type only.

Oil-in-water and water-in-oil emulsions were prepared with the pairs water-amyl alcohol and water-kerosene, with the following emulsifying agents: sodium oleate, magnesium oleate, sodium cetylsulfonate; finely divided carbon (pigment black) and bentonite were used with both water-kerosene and water-amyl alcohol, as were oleic acid, triethanolamine, triethanolamine oleate, saponin, castile soap, rosin soap, sulfonated castor oil, gelatin, finely divided iron, finely divided silicon dioxide and calcium caseinate. The emulsions were prepared by three methods and their stability was measured by determining the time required for 5 cc. of the disperse phase to separate from 50 cc. of the emulsion. In most cases, the stability of the unusual form of the emulsion (for a specific emulsifying agent) is of the same order as that of the usual form. In nearly every case the phase volume ratio and the proportion of the emulsifying agent are identical for the oil-in-water and water-in-oil types.

Inversion

When the amounts of two phases in an emulsion are in a certain proportion an O/W emulsion[8] may be changed to a W/O type.[9] Thus an O/W soap emulsion may be inverted by the addition of calcium or zinc salts, which form metallic soaps that favor the W/O type. This inversion is easily shown by the increase in electrical resistance of the latter.

[7] Cheesman, Trans. Faraday Soc. *34*, 594 (1938).
[8] Wellman, J. Phys. Chem. *34*, 379 (1930).
[9] Bhatnagar, J. Chem. Soc. *117*, 542 (1920); *119*, 61, 1766 (1921).

Inversion may be caused by change in concentration of one of the phases, by chemical or physical changes produced on ageing.

It has been shown in certain emulsions, that when the aqueous soap concentration is increased beyond a certain point some soap is taken up by the other phase. This also occurs when salts are added. In both these cases, as well as in others, where solid or colloidal material is shown in the oil phase, inversion to the W/O results.[10]

Sodium chloride inverts W/O emulsions when the less soluble sodium soaps are used as emulsifiers, but not when the more soluble ones are used. Potassium chloride does not invert emulsions made with corresponding potassium soaps.[11] Cod liver oil emulsions with gum acacia and gum tragacanth change from the less stable O/W to W/O type, during emulsification, caused by slight oxidation of the oil.[12]

W/O crude asphaltic oil emulsions are inverted with potassium or sodium oleate or rosin soap.[13]

Inversion of olive oil emulsions, made with sodium oleate, takes place gradually, not suddenly, in presence of calcium salts.[14]

O/W emulsions of castor, olive, or cod liver oil are formed when using caesium, potassium, sodium, or silver soaps. The degree of emulsification decreasing with atomic volume in above order. Calcium, magnesium, zinc, aluminum, iron hydroxides form W/O emulsions. The stability of these increases inversely with the atomic volume.[15]

Change in type of emulsions of castor or olive oil with

[10] Robertson, Z. Koll. Chem. *7*, 7 (1910).
[11] Tartar, J. Phys. Chem. *34*, 378 (1930).
[12] Smith, Pharm. J. *125*, 91 (1930).
[13] Kadt, J. Inst. Petroleum Tech. *12*, 217 (1926).
[14] Dixon, Sci., Proc. Roy. Dublin Soc. *19*, 421 (1930).
[15] Iselin, Boll. chim. farm. *67*, 225 (1928).

sodium oleate is indicated by a change in surface tension of the emulsion.[16]

Water added to a 4% solution of potassium oleate in white spirit forms a rather unstable water in oil emulsion until the emulsion contains 1% H_2O. A further addition of water results in an inversion of the emulsion and a separation of white spirit. The inversion is prevented if the potassium oleate contains more than 10% oleic acid. When water is absorbed by a white spirit solution containing potassium oleate, oleic acid and methanol, one of the three types of emulsions results. If the oleic acid content is high and the methanol content small, a low-viscosity irrevertible emulsion forms. With solutions low in oleic acid and containing between 30% and 40% methanol a water in oil emulsion of higher viscosity forms which has a tendency to invert. If the methanol content exceeds 50%, no emulsion forms.

Olive oil and lime water when emulsified with small amounts of powdered mustard produce W/O emulsions. Larger amounts of mustard produce O/W type. Fine mustard is more effective than coarse mustard. The stability of mayonnaise is definitely affected by mustard.[17]

In general, emulsions are inverted to W/O if:

1. No electric charge exists in the film
2. Considerable rigidity exists

Addition of multi-valent ions (or charged molecules containing many polar groups) causes discharge (enabling droplets to coalesce) and greater rigidity of the interfacial film through interlacing of film molecules by the added ion.[18]

Univalent electrolytes are incapable of reversing the type

[16] Joshi, Kolloid-Z *34*, 280 (1924).
[17] Corran, Spice Mill *57*, 175 (1934).
[18] Schulman, Trans. Faraday Soc. *36*, 661 (1940).

of soap emulsions, even though they throw the soap out of solution. An excess of adsorbed positive ions on the surface membrane leads to the formation of the water-in-oil type, and negative ions the reverse type of emulsion. Evidence favors the view that the relative wetting power of the two phases with respect to the emulsifying agent and the surface potential of the membrane between them are the main factors governing emulsifications, and that reversal of phases by electrolytes is effected by relevant changes produced in the surface membrane.[17a]

Emulsions of benzene with sodium oleate, and tetrahydronaphthalene with sodium oleate are of the oil-in-water type throughout, and the viscosity decreases continuously with increase in water content. Emulsions of benzene with sulfonated fish oil and caustic soda and tetrahydronaphthalene with sulfonated fish oil and caustic soda are water-in-oil and the viscosity increases with the water content up to 23 and 27% respectively. At these points the systems suddenly change into oil-in-water types and the viscosity increases enormously, after which the viscosity decreases sharply with further increase in water content.[18]

Reversible emulsions (W/O) of castor oil, olive oil and paraffin oil with sodium and potassium soaps increase in viscosity with increase in percentage of the dispersed phase and the viscosity is greatest at the reversal point. The concentration and specific nature of the emulsifying agent have no effect on the viscosity.[19] In pharmacy, a little saponin is often added to gum emulsions to increase their stability.

Saponins also act as protective agents to hydrophil colloids such as the colloidal solutions of the metals, though in gen-

[17a] Bhatnagar, J. Chem. Soc. *119*, 1760 (1921).
[18] Parke, J. Chem. Soc. 1214 (1933).
[19] Joshi, Trans. Faraday Soc. (1925).

eral they are less effective for this purpose than a number of other protective agents.

In using gum arabic [21] for making emulsions, the best amount of gum is the total of the weight of olive oil and twice the weight of the dissolved substance * in it. It seems that the specific gravity of the oil and gum solutions influence, to a great extent, the stability of emulsions.

Lecithin

With olive oil [24] and kerosene,[25] lecithin gives O/W emulsions. It is soluble in various organic solvents [26] and combines with acids and bases. With some non-aqueous fluids, dual type emulsions may be formed because of solute-solvent complexes or by partition of the emulsifier. Such dual emulsions are formed with toluol, benzol, carbon tetrachloride, chloroform, linseed oil, cresylic acid, phenol, hexalin and light petroleum oil. Lecithin gives O/W emulsions [27] with certain bases. Added to soap it increases surface tension and drop number. Foam number is increased and foam volume is decreased.[28]

Impure soyabean lecithin has better emulsifying properties than purified lecithin.[29]

With sunflower oil-in-water emulsions, when the proportion of the phases is not changed, then the most stable emulsions are obtained only with the use of definite amounts of

[21] Westerhof, Pharm. Weekblad *76*, 811 (1939).

* Dissolved substances are the following: bromoform, chloroform, iodoform, carbon tetrachloride, alcohol, diethyl ether, peppermint oil and fennel oil.

[24] J. Phy. Chem. *29*, 587,738,834 (1923).

[25] J. C. S. *119*, 1760 (1921).

[26] Biochem. Z. *32*, 146 (1931).

[27] J. C. S. *51*, c. (1932).

[28] The Soybean Industry, Horwath. p. 134 (1939) Chemical Publishing Co., Inc.

[29] Puchkobskii, Colloid, J. (U. S. S. R.) *3*, 643, (1937).

lecithin;[30] when larger or smaller amounts of lecithin are used unstable emulsions are obtained. When the amount of lecithin is constant, the character of the emulsions depends upon the proportion of water and oil. With slight amounts of oil, mainly oil-in-water emulsions are obtained and with small amounts of water emulsions of water in oil are obtained. The most stable emulsions are obtained when the phases are present in the same ratio as used in the commercial production of margarine.

Gelatin

Gelatins from which organic and inorganic impurities have been removed are more efficient emulsifying agents than the same gelatins with the impurities.[31] The source from which the gelatin is obtained and the treatment to which it is subjected before the gelatin is extracted, has a marked effect on the emulsifying power of the gelatin. Gelatins which have been previously treated with alkali are more efficient as emulsifiers. Oils containing double or triple linkings are more easily emulsified with alkali treated gelatin than saturated hydrocarbon oils.

In using gelatin as an emulsifier the best results are obtained by (1) lowering the surface tension as much as possible: (2) no excess of strong acids, bases or liquefying salts should be added; (3) the viscosity should be as near that of water as possible. No evidence is shown (in kerosene-water emulsions) that gelatin particles are taken up from the solution to form adhesive layers about the oil droplets.[32]

Variation of pH (of emulsions made with gelatin concentration 0.25–1.5%) between pH 3, 4.7 & 6 show little effect. Changing the pH of a gelatin solution alters its emulsi-

[30] Strukova, Chem. Zent. *11*, 1460 (1936).
[31] Kernot, J. Soc. Chem. Ind. *47*, 96 (1928).
[32] Tice, Amer. J. Pharm. *1*, 2 (1939).

fying properties similarly to the changes in its surface tension and viscosity. Stable emulsions show a concentration of gelatin at the interface.[33]

A homogenizer is preferable to a colloid mill in making liquid emulsions with gelatin as it gives finer and more uniform emulsions. It is important to exclude air or other gases as far as possible.

Of the different varieties of gelatin, bone, calf-skin and pork-skin, the latter gave best results in a typical oil emulsion. It does, however, increase the rate of creaming. Gelatins having a high Bloom rating (25g. or higher) give better emulsions. Of course, the method of preparation of the gelatin, its age, purity and isoelectric point, are very important factors. In solutions, gelatin becomes positively charged as the pH decreases below its iso-electric point.[34] Dispersed oil particles bear a negative charge. To further adsorption of gelatin at the oil-water interface, it is necessary to build up the electrical charge at the interface. Using pork-skin gelatin of a good grade, pH 3 was found most suitable. Since good commercial gelatins have a higher pH, the latter is decreased by the addition of acid (tartaric acid is used for pharmaceutical emulsions). Alcohol, sugar and glycerin are compatible with gelatin emulsions. The latter two, in certain quantities, improve the emulsion. Emulsions made with hot gelatin solutions are more stable than when cold gelatin solution is used.

Gelatin solutions hydrolyze on warming and on ageing. Hydrolysis produces less viscous emulsions but does not hurt stability very much.

An alkali treated high grade gelatin (Pharmagel B) of isoelectric point 4.7 requires a much higher pH (around 8)

[33] Ahukov, J. Russ. Phys. Chem. Soc. *59,* 1061 (1927).
e, J. Amer. Pharm. Assn. *24,* 1063 (1935).

for making good emulsions. The pH is adjusted with sodium bicarbonate.

Maximum stability of benzene emulsions with gelatin is at the latter's iso-electric point. Non-hydrated and undissociated gelatin molecules serve as best emulsifying agents.[33]

Gums such as acacia, tragacanth and agar show a negative charge formed between the oppositely charged colloids.[36]

Where casein is treated with an aqueous alkali the latter reacts with some of the acidic components to form an emulsifier which disperses the balance of the casein. The greater the amount of certain alkalies used, the more nearly transparent the dispersion becomes.

Albumen is positively charged in acid solution and negatively charged in alkaline solution.[35]

Soaps

Soaps used most frequently as emulsifiers are the sodium or potassium salts of lauric, oleic, palmitic and stearic acids or mixtures of these. They are easily hydrated (solvable), foam in water, lower surface tension and increase detergency. They ionize like salts in water, but show only half the osmotic pressure of the latter. As the temperature of an aqueous soap solution increases the particle size tends to change from colloidal to molecular. Thus, soap solutions are composed of colloidal particles, colloidal ionic micellae and simple ions. Hydrolysis is only slight and any free fatty acid recombines to form an acid soap.[37] Acid soaps are sometimes better emulsifiers than neutral or alkaline soaps. Thus, a dilute potassium laurate that would not produce a

[33] Ahukov, J. Russ. Phys. Chem. Soc. *59*, 1061 (1927).
[36] De Jong, Biochem. Z–(1929).
[35] Hofmeister's Beitr. Chem. Physiol. *5–27*, (1904); Pfluger's Archiv. *24*, 247 (1887).
[37] Alexander, Colloid Chemistry *1*, 137 (1926).

good emulsion with benzene is considerably improved by the addition of a little lauric acid.[38]

Soaps will take up considerable amounts of water, the amounts increasing with the molecular weight of the fatty acid radical. Thus, 1 gram molecule of sodium arachidate will hold 37 liters water.[39] Alcohol and other solvents are taken up similarly.

Emulsifying power of sodium soaps increase up to N/300 soap solution, above which there is a decrease due to the coagulating effect of sodium ions.[40] The optimum amount of soap for benzene emulsions is 0.01% of the total volume.[41]

Potassium soaps are preferable to sodium and ammonium soaps. The latter decompose and liberate free fatty acid which, is often objectionable.

Naphthenic acid soaps [43] are suitable for the preparation of emulsions, but particular care must be taken in determining the amount of alkali necessary for saponification; excess of sodium hydroxide or potassium hydroxide causes rapid disintegration of the emulsion, whereas in saponification with ammonia an excess (up to twice the theoretical amount) must be present in order to stabilize the emulsion. The sodium salt of naphthenic acid is less easily hydrolyzed in water than are the common sodium soaps and its emulsifying powers are much better.

In making emulsions with triethanolamine soaps, quick thorough agitation is necessary. If the agitation is too vigorous or too prolonged, the emulsion tends to break.[44]

Stable W/O emulsions (with metallic soaps) [45] are best

[38] McBain, J. Amer. Chem. Soc. *54,* 3266 (1932).
[39] Fisher, Soaps & Proteins.
[40] Donnan, Kolloid-Z *1,* 208 (1910)..
[41] Briggs, J. Phys. Chem. 19, 479 (1915).
[43] Ohl, Monatsh. Seide Kuntseide *43,* 235 (1938).
[44] Freeman, J. Am. Pharm. Assoc. *22,* 232 (1933).
[45] Pink, Trans. Faraday Soc. *37* 180 (1941).

when the soap does not dissolve in either phase and remains at the interface being partially wetted by both phases, and when there is sufficient lateral adhesion between the soap particles.

Variation of the hydro-carbon chain of soaps has little effect upon distribution of particles in an emulsion, except in the case of potassium chaulmoograte.[46]

The emulsifying power of soaps toward the system water-benzene is in decreasing order castor oil soap, sodium oleate, coconut soap.[47] This is exactly the reverse of the series for foam formation. By the method of phase reversal, it is shown that the hydrophilic order of the soaps is the same as the order of their emulsifying power. In the presence of calcium ion coconut soap gives the most stable water-in-oil emulsion at a concentration of 0.05% and castor oil soap at 0.01%. Kaolin particles less than ten microns in diameter also stabilize water-in-oil emulsions and therefore are hydrophilic.

Partial polyhydric esters of higher fatty acids.[48a] The only polyhydric alcohol fatty acid esters occurring naturally are the triglycerides which are present in various animal, vegetable and fish oils and fats.

Fatty acid esters of polyhydroxy alcohols having a higher molecular weight than glycol and glycerol, as well as esters ot glycol ethers, have recently been made available commercially. These are exemplified by the fatty acid esters of mannitol, sorbitol, glycol ethers, polymerized glycols and glycerin.

The glyceryl esters of stearic acid will serve to illustrate the structural formulae of these materials:

[46] Harkins, J. Am. Chem. Soc. *51,* 1674 (1929).
[47] Smirnov, Vs. Na. Is. Inst. Zhirov 116 (1935).
[48a] Catalog Glyco Products Co. Inc., Brooklyn, N. Y.

GLYCERYL MONOSTEARATE

$$
\begin{array}{l}
\quad\quad\;\; O \\
\quad\quad\;\; \| \\
H_2C\text{-}O\text{-}C\text{-}C_{17}H_{35} \\
\quad\;\; | \\
HC\text{-}OH \\
\quad\;\; | \\
H_2C\text{-}OH
\end{array}
$$

GLYCERYL DISTEARATE

$$
\begin{array}{l}
\quad\quad\;\; O \\
\quad\quad\;\; \| \\
H_2C\text{-}O\text{-}C\text{-}C_{17}H_{35} \\
\quad\;\; | \\
HC\text{-}O\text{-}CO\text{-}C_{17}H_{35} \\
\quad\;\; | \\
H_2C\text{-}OH
\end{array}
$$

It must, however, be borne in mind that the usual commercial products are not single chemical entities but are mixtures of the mono fatty acid esters, the di-fatty acid esters and, in the case of the glyceryl and hexahydric compounds, small percentages of the tri-esters with perhaps a percentage of free fatty acid. Furthermore, as these are poor emulsifying agents, the addition of small amounts of soap, wetting agent or other surface-tension reducing agents is sometimes necessary to give them emulsifying and wetting properties. It is interesting to note that the amount of surface tension reducing agent necessary is extremely small, the resultant emulsifying power being greatly in excess of that of the ester and soap separately.

Liquid esters of the emulsifying type are being used as emulsifying agents in the manufacture of fluid emulsions in textiles, paper, leather, polishes, cosmetics, and certain types of edible emulsions.

The solid esters of the emulsifying type give stable cream or paste emulsions for numerous industries. They are also of interest as suspending agents in aqueous media, lubricants, shortenings and other edible products.

Typical emulsifiers in this group are:

Glyceryl (Mono) Ricinolate
Glyceryl (Mono) Stearate
Mannitol Glyceryl (Mono) Laurate
Mannitol Glyceryl (Mono) Oleate

Mannitol (Tri) Ricinoleate
Mannitol Glyceryl (Mono) Stearate
Polymerized Glycol (Di) Laurate
Polymerized Glycol (Mono) Laurate
Polymerized Glycol (Di) Oleate
Polymerized Glycol (Mono) Oleate
Polymerized Glycol (Di) Stearate
Polymerized Glycol (Mono) Stearate
Propylene Glycol (Mono) Laurate
Propylene Glycol (Mono) Oleate
Propylene Glycol (Mono) Ricinoleate
Propylene Glycol (Mono) Stearate
Propylene Glycol Glyceryl (Mono) Stearate
Sorbitol Laurate
Sorbitol (Di) Laurate
Sorbitol (Di) Stearate
Sorbitol Glyceryl (Mono) Laurate
Sorbitol Glyceryl (Mono) Oleate
Sorbitol Glyceryl (Mono) Stearate
Diethylene Glycol (Mono) Laurate
Diethylene Glycol (Mono) Myristate
Diethylene Glycol (Mono) Oleate
Diethylene Glycol Glyceryl (Mono) Oleate
Diethylene Glycol (Mono) Palmitate
Diethylene Glycol Palmitate Stearate
Diethylene Glycol (Mono) Ricinoleate
Diethylene Glycol Glyceryl (Mono) Ricinoleate
Diethylene Glycol Stearate
Diethylene Glycol (Mono) Stearate
Diethylene Glycol Glyceryl (Mono) Stearate
Ethylene Glycol (Mono) Laurate
Ethylene Glycol (Mono) Oleate
Ethylene Glycol (Mono) Ricinoleate
Ethylene Glycol (Mono) Stearate
Glyceryl (Mono) Laurate
Glyceryl (Mono) Myristate
Glyceryl (Mono) Oleate
Glyceryl (Mono) Palmitate

Twitchell Reagent

The emulsifying power of Twitchell reagent [48] on olive oil is increased by acid. The stronger the acid, the greater the effect.

Addition of salts of weak acids has but little influence on such emulsions. Strong electrolytes (sodium chloride) increase emulsification. Higher concentrations of salt, salt out the emulsifier and break the emulsion.

The emulsifying power of the sodium salts of the reagent is lower than that of the reagent. Emulsifying power is increased here by certain amounts of glycerol or fatty acids.

Insoluble Emulsifying Agents.

The most useful emulsifying agent in this class is bentonite. While many solids have been used as emulsifiers most of them give coarse temporary emulsions. Hydrous oxides and hydroxides of metals are most effective, their emulsifying efficiency varying with the method of precipitation. The most gelatinous, highly dispersed products are usually best; gelatinous precipitates other than oxides and hydroxides are also effective. Ageing in some cases helps and in other cases hinders their emulsifying power.

Aged aluminum hydroxide and partially coagulated ferric hydroxide solutions are better than freshly precipated materials.

Nearly all colloidal hydroxides give O/W emulsions.

Emulsions made with gelatinous hydroxides although rather coarse are quite stable and are not effected by electrolytes. Finer dispersions are obtained by combining surface-active materials with them.[50]

The following is a list of some insoluble emulsifying agents

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[48] Nishizawa, Chem. Unscha Fette *36*, 277, (1929).
[50] Bennistee, J. Soc. Chem. Ind. *59*, 226 (1941).

used; moist basic metallic sulfates,[51] plaster of Paris, calcium carbonate, powdered coals. The finer the particle size of the emulsifier the finer the emulsified droplets. When O/W emulsions are to be formed the emulsifier should be preferentially wetted by water. Other insoluble emulsifiers are arsenic trisulfide;[52] zinc and iron dust, yeast;[53] hydroxides of zinc, lead and aluminum[54] (when pure and in low concentration these give W/O and O/W on addition of electrolytes); carbon black and lampblack gives W/O[55] with kerosene; a very stable emulsion of gasoline is prepared with carbon black.[56] The greater the concentration of insoluble emulsifier the finer the droplet size.[57]

Both W/O and O/W emulsions have been made[58] with bentonite, lead sulfate emulsifies nitrobenzol in mineral acids,[59] kieselguhr,[60] and bauxite.[61]

The following technical aspects of emulsification are discussed in detail by Langton:[62] fatty oil saponification, manufacture of margarine, compound fats, lubricants, asphalt and bitumen emulsions.

The amount of emulsifier used[63] is different for each specific emulsifier. Thus 0.5% gelatin may form a stable emulsion whereas attainment of the same stability may require the use of 4% lecithin. The amount of emulsifier necessary is usually greater than that required to form a uni-

[51] Pickering, J. C. S. *91*, 2001 (1907).
[52] Briggs, Ind. & Eng. Chem. *13*, 1008 (1921).
[53] Bhatnagar, J. C. S. *119*, 1760 (1921).
[54] Bechold, Kolloid Z. *28*, 6 (1921).
[55] Schloepfer, J. C. S. *113*, 522 (1918).
[56] Odell, U. S. Bureau of Mines Technical Paper *304*, 36 (1923).
[57] Moore, J. Amer. Ch. Soc. *41*, 940 (1919).
[58] Western, Chem. Age *4*, 604, 638 (1921).
[59] Sheppard, J. Phy. Chem. *23*, 634 (1919).
[60] Lapworth, J. C. S. *119*, 765 (1921).
[61] King, J. S. C. I. *57*, 431 (1938).
[62] Langton, Ind. Chemist *3*, 457 (1927).
[63] Brown, Textile Colorist *57*, 516 (1935).

molecular layer, especially if hydration occurs. The excess may be in the continuous phase or it may be adsorbed on the covered globules of the disperse phase. This tends to increase viscosity and augment stability. The greater the amount of emulsifier (within certain limits) the smaller the particle size of the emulsion. Therefore, the smaller the particle size desired, the greater amount of emulsifier necessary. Where an emulsion is made with a minimal amount of emulsifier there is a tendency toward liberation of the oil phase and creaming or breaking.

Foams

Pure liquids do not foam.[18a] Some impurity must be present in a liquid to make it foam. Expressed chemically, a foreign substance must be molecularly or colloidally dispersed in a liquid in order to make foam. The nature of the added substance has little qualitative effect—that is, nearly all substances induce foaming. In a quantitative sense, however, there are great differences. A few thousandths of one per cent of some substances produces more foam than several per cent of others. and there is, furthermore, great difference in the stability of the different foams.

Qualitatively speaking, it does not matter whether the added substance is positively or negatively absorbed—that is, is more or less concentrated in the surface than in the interior of the liquid. In either case foam may be produced. Since positively adsorbed substances lower the surface tension and negatively adsorbed substances raise it, it is apparent that there is a correlation between foaminess and surface tension.

Certain substances called antifoams, have the power of destroying foam or preventing the formation of foams pro-

[a] Foulk, Ind. & Eng. Chem. *21,* 815 (1929).

duced by positively adsorbed or negatively adsorbed substances. Castor oil, for example, destroys the foam produced by the positively adsorbed saponin and also that caused by the negatively adsorbed sodium sulfate. Quantitatively considered, the defoaming agents, like the foam producers, are at times effective in concentrations of only a few thousandths of a per cent.

The fundamental condition for the formation of a foam requires that there be a difference of concentration of the dissolved substance in the surface layer, as compared to the concentration of the substance in the bulk of the solution.

If the tension in the film is increased by increasing the area, the concentration of the wetting agent or surface active compound is reduced, thus balancing the increase in tension. Conversely, if the tension of the film is reduced by reducing the area of the concentration the wetting agent is increased and surface tension will be decreased to balance the reduced tension. If a material is too soluble, or too insoluble, it will not produce a copious foam. (A 0.2% concentration of the dioctyl ester of sulphonated dicarboxylic acid forms more foam and a more stable foam than a 0.2% concentration of the dibutyl ester of sulphonated dicarboxylic acid.) Likewise, a 0.2% solution of a sulphated higher alcohol, produces more of a froth and a more stable froth than either of the other two materials. This is in line with experience that detergent-type surface active products are generally better foamers than wetting agent types.[8a]

The most commonly used foam-breakers, outside of those used in the natural petroleum industry are:

Higher fatty alcohols, e.g., cetyl alcohol	Ammonium linoleate
	Alcohol, denatured
Diglycol laurate	Octyl alcohol

[8a] Sluhan, Paper Trade Jol. p. 1, Aug., 22, 1940.

Pine oil	Water soluble salts,
Mineral oil	e.g., sodium sulfate
"Foamex" [8b]	Acids, e.g., acetic acid
Sulfonated oils	Tallow
Vegetable oils	

Mechanical methods such as beating or stirring near the surface of a foaming liquid; the use of screens, a blast of air, and similar devices are frequently used.

Hydrocarbons, carbon tetrachloride, chloroform and carbon disulphide have little or no effect [9] on the formation of foams. Organic acids, alcohols, amines, aldehydes, ketones, glycerol, sugar, although an aid in the production of foams decrease their stability. The optimal concentration in 35 such compounds for a maximum of foam is given by Bartsch. Surface activity, solubility, degree of dispersion and viscosity are factors in the effectiveness of each substance. In all dilute solutions the foam-forming power increases with increasing surface activity. In concentrated solutions, the influence of dispersion, solubility and viscosity subdue that of surface activity. The surface tension optimal for foam-building, of many solutions, approaches a mean value so that one may speak of the isocapillarity of these solutions. Molecular association or colloidal aggregation decreases the foam-building power of surface-active substances. High viscosity may not aid in the formation of foam, but increases its stability. Mixed solutions of surface-active substances have greater foam-building power than the solution of just one component, unless mixing lowers the solubility. Under the influence of electrolytes, foams usually behave as negatively charged lyophobes. Cations exert a flocculating effect according to their valence, and protective colloids protect in accordance with their gold number. The ability to form foam is con-

[8b] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[9] O. Bartsch, Kolloidchem. Beihefte, *20,* 1 (1924).

ditioned by the heterogeneity of the Gibbs layer with regard to the component molecules. The characteristics of a three-phase foam system is primarily dependent on the concentration of the foam builder or stabilizer. There is no sharp division between the three-phase emulsion and three-phase foam. Protective colloids may hinder the formation of foam. The maximum stability is reached when the adsorbed layer of fatty acid is one molecule thick on the solid phase.

Egg-white foam [10] is an emulsion of air in liquid, in which there is a concentration of the coagulated protein at the air-liquid interface, which forms a tough skin about 1 molecule thick, thus permitting the emulsion to be semi-stable. The lighter the foam, the less the wall thickness, and there is a point at which the two surfaces are connected by what appears to be a long chain of albumin molecules (possibly coagulated). This gives to the foam the quality of dryness. Egg white is composed of microscopic fibers of protein which make the viscosity very high. On beating, these fibers are cut and torn and a relatively low viscosity results. This allows for the production of a highly dispersed foam. The stability of the foam is a linear function of the viscosity of the egg white drained from it. When certain acids or salts are added to egg white thereby decreasing its pH, a change is produced which is partly due to an increase in viscosity and partly due to some change in the nature of the protein. The result is a more stable foam.

A heterogeneous system consisting of acetic acid-diethyl ether-water acts both foamy and non-foamy [11] according to the different methods of shaking. This behavior is dependent on the type of emulsions produced. Accordingly the heterogeneous region of this system is divided into three parts,

[10] Barmore, Colo. Agr. Exp. Sta. 46th Ann. Report 15 (1933).
[11] Sasaki, Bull. Chem. Soc. Japan 1r, 63 (1939).

namely, oil-in-water region, water-in-oil region and phase-inversion zone. In the latter, both types of emulsion may be produced by different technics of shaking.

A study of salts of triethanolamine [12] indicates that the surface tension decreases and the relative foam production increases with the number of carbon atoms of the saturated fatty acid up to 12, and then decreases. The pH increases with the number of carbon atoms. The stearate, oleate and laurate exhibit the best emulsifying powers.

Spent licorice root [13] is extracted under pressure with 5% caustic soda, and is then concentrated. This acts as a foam stabilizer, giving a tough durable film.

Foamapin [14] a hydrolyzed protein, gives an excellent tenacious foam film in water. Its durability can be further increased by the addition of inorganic salts.

Stability of whey foams may be greatly increased by addition of (1) small quantities of calcium hydroxide [15] and its subsequent neutralization; (2) successive small quantities of acid and alkali to the foam while whipping; (3) small amounts of tannic acid, saponin, sodium sulfite or bisulfite. If, in addition to any of the above, the whey solution is heated to 50°C. before whipping, volume and stability of foam is increased.

The following materials are listed according to the descending order of their foaming power in hydrophilic colloids.[16] Saponin, molasses, peptone, gelatin, albumin, pectin, casein. For albumin the maximum foaming power occurs just below the coagulation temperature, and maximal foam stability is

[12] Fiero, J. Am. Pharm. Assoc. *27,* 658 (1938).
[13] Houseman, J. Ind. Eng. Che., *21,* 917 (1929).
[14] Glyco Products Co., Inc., Brooklyn, N. Y.
[15] Peter, J. Ind. & Eng. Chem. *22,* 1124 (1930).
[16] Dumanskii, Schr. z. biochem. Forsch inst. Nahr. (U.S.S.R.) *3,* 361 (1933).

found at pH 4.7. Replacing air by carbon dioxide or sulfur dioxide decreases the stability but not the amount of the foam.

Soaps foam in following order: [17]

Castile soap
Palm Oil soap
Tallow soap
Solidpotash soap
Palm kernel oil soap
Rosin soap

The foaming quality of soaps in hard water, increases when the solution stands. Colloidal substances do not help foaming of soaps or increase the life of the foam.

Clay lowers foaming quality of soaps.

0.001–0.5% of montan wax or I.G. waxes are dissolved in a soluble oil [18] to suppress foam when mixed with water.

Uniform pressure does not destroy foam.[19] Unilateral pressure does destroy foam by strong deformation of the bubbles.

[17] Anon. Soap *10,* 19 (1926).
[18] Zimmer, U. S. 2, 230, 556 (1941).
[19] Siehr, Kolloid-Z. *78,* 156 (1937).

CHAPTER III

METHODS, FORMULATION, EQUIPMENT

Methods

WHILE there are numerous ways of making emulsions the simplest is to add the oil phase slowly, with stirring, to a concentrated water solution of soap. Further amounts of water may be stirred in.

It is often advantageous to add the internal phase to the external phase slowly; to use a preformed dilute emulsion;[1] a preformed concentrated emulsion;[2, 3] to use a preformed emulsion using a different emulsifier than that used in the main emulsion;[4] to remove part of finished emulsion and add an unemulsified phase.[5, 6]

Beating in of too much air causes excessive froth formation which is detrimental. Dilution of a concentrated emulsion should be slow to avoid complications.[7]

For emulsions of O/W type it is usual to put the emulsifying agent in the water phase. When soap is used it may be dissolved in the water phase or it may be formed *in situ* by

[1] Brit. 4,505 (1912).
[2] Lechler, Brit. 254, 701 (1925).
[3] Billinghame, U. S. 1,700,581 (1929).
[4] Braun, Brit. 254,012 (1925).
[5] Robinson, U. S. 1,923,888 (1933).
[6] Neveu, U. S. 1,525,409 (1925).
[7] Brown, Textile Colorist *57,* 516 (1935).

dissolving the alkali in the water and the fatty acid in the oil phase. The latter method often gives better dispersions because the emulsion forms spontaneously as soon as the two phases meet. Furthermore, less power is necessary for mixing in such a case. Certain emulsifiers which are dispersible in both water and oils (e.g., diglycol laurate) may be dissolved in either the water or oil phase or both, depending on results desired.

The effect of concentration of emulsifiers (albumin, sodium caseinate and casein lactate) and of stirring speed on emulsions is very important.

In making oil emulsions with soap, the oil and water is alternately mixed into the concentrated aqueous soap solution. When a wax is being emulsified, it is usual to run the melted wax into the hot soap solution containing all the water. When emulsifying mineral oil with soaps that are soluble in it, a solution of the two is made and then stirred into the water.

Mineral oil emulsions, however, can be made without an emulsifier, by shaking a small amount of oil with a large amount of water for 48 hours; by boiling a similar ratio under reflux for 30 hours; by dissolving a similar ratio in alcohol and pouring into water.[8]

For petroleum solvents the alkali is dissolved in water and the fatty acid in the solvent. On mixing these solutions soap is formed spontaneously and often gives a finer dispersion than other methods of mixing.

In making an emulsion of a new oil, work the oil gradually into a concentrated soap solution. If the oil does not emulsify well, add water, a little at a time, working it in well. A gel or paste usually forms. Here more oil can be stirred in. If there is incomplete emulsification add water again. This

[8] Lewis, Kolloid-Z *4*, 211 (1909).

procedure is not required in all cases, but is often very helpful when an emulsion is made for the first time. In making duplications the entire amount of oil or water may be stirred in more rapidly.

Gums are used as emulsifiers in the following ways: [9]

The Continental method: Oil is ground to a paste with powdered gum acacia. The water is added in two parts, the first part being worked into the paste, before adding the second part.

The English method: A mucilage of gum acacia and water is formed and the oil and water is worked in, in successive small portions.

Gum emulsifiers should not be thinned down too much with water as instability will result.[10]

Two immiscible liquids can be emulsified with the help of an insoluble powder, such as clay, zinc dust, or yeast.[11] The emulsification depends on the fineness of the powder, on the quantity of the solid phase, and on the presence of certain substances which are soluble in one or both liquid phases and which influence the wetting of the powder by both phases. These substances include acids, bases and salts, both electrolytic and non-electrolytic. Geometrical considerations have shown that for complete emulsification the optimal ratio of inner to outer phase should be 74—to 26; experimental results show the optimum ratio to be 60 to 80 volumes of the inner to 20 to 40 volumes of the outer phase. The volume of the emulsion is influenced by the specific weights of the solid and liquid phases; great differences in specific weight decrease the emulsion volume.

Bentonite, the most widely used insoluble powder is dispersed properly by adding it to water, a little at a time, and

[9] Serralach, J. Ind. & Eng. Chem. *25,* 817 (1933).
[10] Roon, J. Ind. & Eng. Chem. *9,* 156 (1917).
[11] Bechhold, Kolloid-Z *28,* 6 (1921).

allowing it to sink before adding the next portion. When all the bentonite has been added, allow it to soak for one or two hours, before stirring. Up to 7 or 8% bentonite may be dispersed in this way.

If a high speed mixer is available, the bentonite can be added slowly while mixing, and dispersion can be effected in a few minutes. This method and longer mixing may yield dispersion up to 17%.

Emulsification by Ultrasonic Waves

Ultrasonic waves [12] are a source of strong mechanical energy which greatly accelerates the speed of molecules within a limited area. Such a source of energy rapidly disperses mercury in water. The proportion of the phases is a critical factor in these emulsions, which are only stable for a day.

More stable emulsions have been obtained with Wood's metal in certain organic liquid-like brombenzene. The stability is further increased by the presence of highly charged and strongly adsorbed ions.

Increasing the disperse phase, beyond a certain point, is not possible even if the treatment time is greatly extended. If treatment of a good emulsion is continued too long, breaking often results. The inclusion of a protective colloid, however, may prevent this. Highly viscous or elastic materials do not emulsify on ultrasonic treatment.

Emulsification in oil-water systems by ultrasonic waves [13] is due to cavitation, emulsification occurring when the cavities collapse. With constant frequency vibration the emulsification increases over a range of 100 to 1500 mm. of mercury pressure, but decreases above this point. Some pressure is necessary to cause efficient collapse, but too high a

[12] Science Progress *23*, 1, 75 (1928).
[13] Bondy, Trans. Faraday Soc. *31*, 835 (1935).

pressure causes the dissolved gases to buffer the collapse or else does not favor the formation of nuclei. Some dissolved gas is necessary for efficient emulsification, for it aids in the formation of nuclei for cavitation.

Emulsifying High Melting Materials

When an emulsion of a solid melting above 100°C. is desired, it should first be melted with sufficient solvent or oil to reduce the combined melting point below 100°C. For example, rubber with naphtha or other hydrocarbons; synthetic resins with hydrocarbons or vegetable oils.

Formulation

The first factor in formulation is the ratio of the oil to the water phase. Usually, an increase in amount of the water phase will result in a lowered viscosity of the emulsion. Often, the decreasing of the amount of the water phase may cause inversion. Low percentages of water in many emulsions produce pasty or even solid emulsions. Since increased viscosity usually increases stability, viscous (concentrated) emulsions are frequently made so that aging and mechanical shock will not break them. These are diluted as required before use.

The amount of the emulsifier used is dependent on many factors, viz., stability, viscosity, type, color, costs, and so forth. It is usual to start out with an amount equal to that used in similar emulsions and work up or down depending on desired results. It is best to work with parts by weight for all ingredients in order to avoid errors due to differences in densities.

Since a test of stability may require "shelf-testing" for some length of time it is best to make up a number of experimental emulsions varying the components (within certain limits) and allowing them to age.

Variations due to formulation or method

Tars and asphalt emulsions made with caustic soda depend on and vary with the following factors:[1]

(1) The type of emulsion depends on the order of introduction of phases, the percentage of phase, and the percentage of potassium hydroxide content in emulsions; (2) the particle size of the dispersed phase varies within close limits; (3) the color of the emulsion depends on that of the prime materials used; (4) the stability of the emulsions depends on type, percentage of tar or mixture of tar-asphalt and viscosity; (5) the viscosity increases with increase in added phase, regardless of whether it is tar or water.

Mechanical forces are instrumental in producing most emulsions. The simplest equipment is a small container which is shaken manually. A second method is stirring, either by hand or mechanically. Finally, there is the machine, such as the colloid mill or homogenizer.

In pharmacy, the mortar and pestle is the most commonly used emulsifying apparatus. The so called American method introduces the oil phase to the gum dispersion, whereas in the Continental method the water is added to the gum and oil. Both these methods use vigorous agitation and grinding.

Standardized hand shaking of a bottle or closed container is the technic which most closely duplicates mechanical forces and is used in many studies on making and breaking emulsions.[2]

Mixing by agitation is not a simple, uniform operation. The shaft, from the source of power, may be fitted with a propeller, whisk, baffle or similar projection. To get the most efficient dispersion, shearing as well as mixing forces are needed. The size, shape and position of both the container

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[1] Verona, Bul. Chim. Soc. Rom. *38*, 91 (1935).
[2] Clayton, Theory of Emulsions (1928).

and the attachments are of great importance, not only in getting better dispersions, but in avoiding the introduction of excessive amounts of air.

For every emulsifying apparatus or machine there exists an optimal speed of agitation or mixing and an optimal operating time, whereby the most stable emulsion can be attained for a given mixture. Intermittent shaking may be 600 or even 1000 times more effective than uninterrupted but equally violent agitation. A mixture of benzene in 1 per cent aqueous sodium oleate, when shaken by hand, requires 750 shakes occupying 4.2 minutes, to emulsify 60 per cent by volume of benzene. The same mixture can be completely emulsified with 5 shakes in less than 1 minute, if after shaking twice a rest of 30 seconds is permitted.

This example is mentioned to illustrate the point that results are often unpredictable and are best ascertained by experiment.

Most emulsions are made by means of electric mixers of various types. It is important to select the right type and size of mixer. The number of propellers on the shaft, their location, angle and pitch are likewise often critical.

To get uniform dispersions it is important that the pressure remains fairly constant. Since the pressure, at which the emulsion is brought to the homogenizing valve, may vary, it is important that the valves be quickly responsive to slight pressure variations. The higher the pressure used, the finer is the dispersion. The pressure however, is definitely limited by the size of the inlet valves and the viscosity of the emulsion. Formation of vacuum and air pockets in the compression chamber causes lowered production and variable finished emulsions.

Pressures used vary between 1000 and 5000 lb. sq. in.

Often two stages of homogenization are used; the first at high pressure and the second at a lower pressure. Such a

procedure is used with milk to prevent creaming and excessive viscosity.

Number of Propellers *

Generally mixers with one propeller are used with liquids having low viscosity, such as water solutions, oils, light syrups, varnishes, milks, etc.

Two propellers on the mixer shaft are called for with liquids of high viscosity where one propeller cannot set up circulation throughout the entire mass of liquid; also where the liquid in the tank varies in height from time to time.

Note mixing action of single propeller, Fig. No. 1; double propeller, Fig. No. 2. Remember that when two propellers are placed on the mixer shaft, where one propeller requires a certain horse power, each of the two propellers substituted will require approximately half of the horse power as shown by the one large propeller.

Mixer Speed

A high speed mixer is called for with low viscosity liquids, such as water solutions, light syrups, light oils, varnishes, etc., while low speed mixers are used in high viscosity work where mixes are thick, slippery, etc. Where mix contains crystals, fruit or other solid particles, or tends to foam, low speed units are designated.

Materials containing colloidal matter, such as milk or cream, also require low speeds.

There are also materials requiring medium speeds, such as heavy oils and paints. By high speed we mean 1400 to 1800 R.P.M.; medium 1150 R.P.M.; low speeds 100 to 500, generally around 400 R.P.M.

Wherever possible it is suggested that you use a high speed

* Courtesy of International Engineering Inc., Dayton, O.

FIG. No. 1

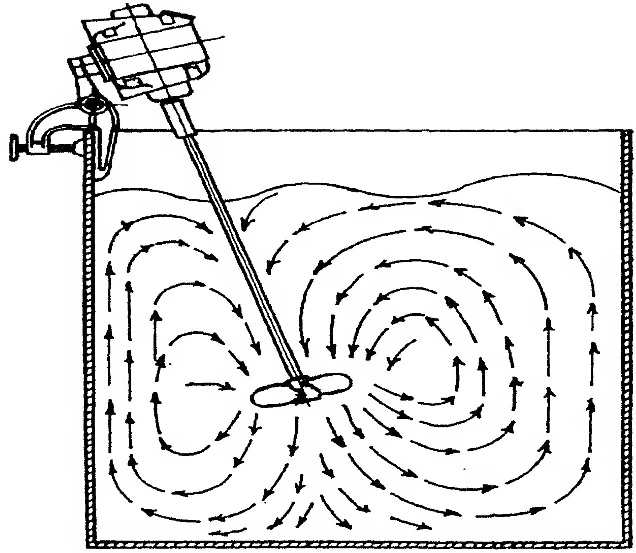
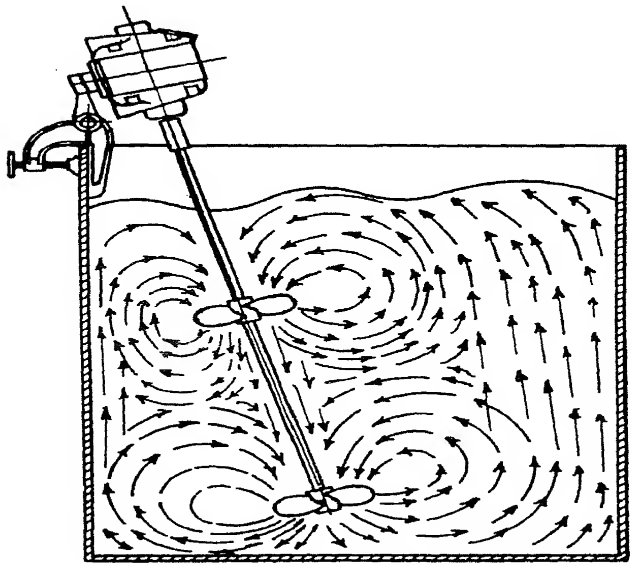


FIG. No. 2



job, as its original cost is less, and it can be handled easier because of its lighter weight.

Horse Power Required

The horse power required to mix a certain definite quantity of liquid depends entirely upon the viscosity of the liquid. As an example, a cosmetic cream will require 3 to 4 times the power per gallon as compared with an aqueous solution, while rapid agitation of an aqueous solution will take 3 or 4 times the power per gallon as compared with slow agitation.

The following table will give you the approximate horse powers where working on average materials for various capacity tanks, and an approximate comparison of thin or low viscosity liquids with the other extreme, thick high viscosity material, such as pastes, creams and mayonnaise.

APPROXIMATE AVERAGE HORSEPOWER

	SLOW AGITATION		RAPID AGITATION	
GALLONS	AQUEOUS SOLUTION	PASTE	AQUEOUS SOLUTION	PASTE
15 to 20	1/30	¼	⅛	½
30 to 40	1/20	⅓	¼	¾
60 to 90	1/20	½	⅓	1
150	⅛	¾	½	1½
250–350	¼	1	¾	2
500	⅓	1½	1	3
800	½	2	1½	5
1200	¾	3	2	7½
2000	1	5	3	10
3000	1½	7½	5	
5000	2	10	7½	
7500	3		10	

NOTE: Medium agitation can be figured to average approximately ⅔ of the above Rapid Agitation.

Miscellaneous Points

The best type of tank for mixing is cylindrical. Steam coils or other obstructions in a tank somewhat impede mixer action and often require added horsepower. Rectangular tanks usually require more power than plain cylindrical tanks.

Where mixers are to be used with different sized propellers, the motor H. P. used should be equal to the largest propeller required. With rectangular or special shaped tanks, it is often best to use two mixers of smaller size.

Among the precursors of the modern emulsifying machine, is found a type which forced the components through a small opening or between two surfaces in motion.[3] Another type forced a preliminary emulsion through capillary tubes at high pressure.[4] A third type continuously forced the preliminary emulsion through a conical spring valve.[5] The "colloid mill" invented by Plauson, forces the liquid between a rapidly moving rotor and a stator. The term "colloid" mill is a misnomer as particles of colloidal size are not necessarily produced by it.

Colloid Mills

Colloid Mills,* through popular acceptance and wide usage, have come to be defined as—machines whose functions are to disintegrate, disperse, emulsify and mix, otherwise immiscible materials. A true colloid mill should be capable of so reducing the particle size of the materials being treated that they will remain in suspension without separation or settling for long periods of time. In achieving stability, of

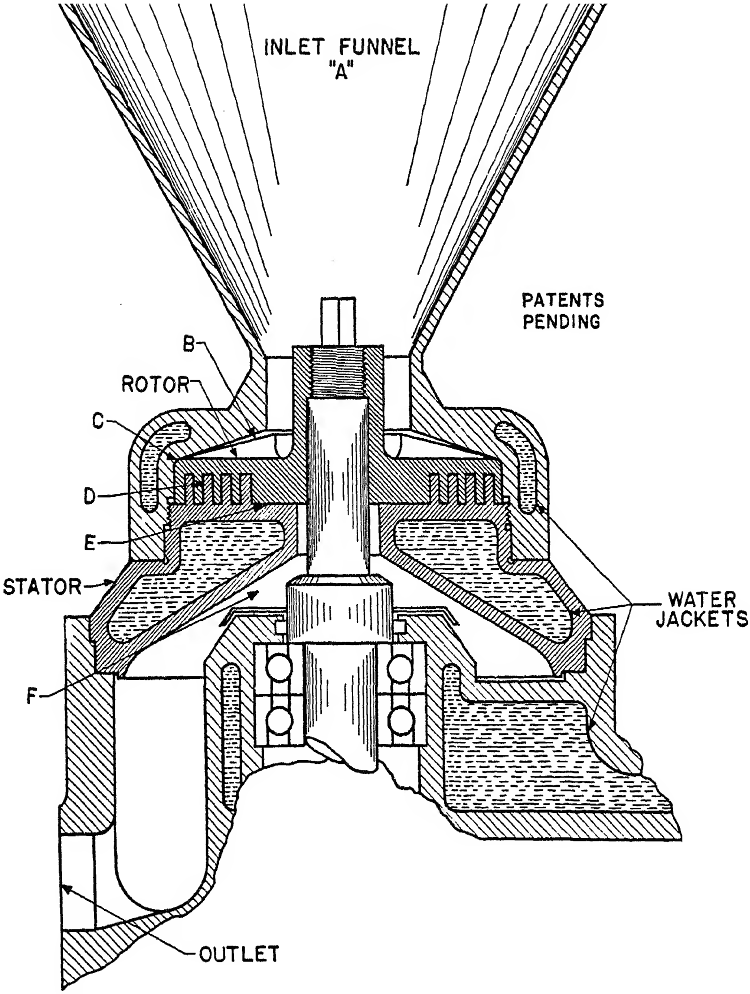
[3] Marix, Fr. 218,946, 218,947 (1892).
[4] Gaulin, Fr. 295,597 (1899).
[5] Gaulin, Brit. 22,875 (1904).
* Courtesy of C. O. Bartlett-Snow Co., Cleveland, O.

emulsions or dispersions, it is sometimes necessary to resort to the use of various chemicals, gums, etc., but it is the responsibility of the colloid mill to produce the initial fineness of dispersion or emulsification.

Any attempt to list all of the industries in which the colloid mill does, or should, find a place would be a huge task, as new uses are found almost daily for this versatile equipment. It is a long step from asphaltic materials and road surfacings, to dairy products, mayonnaise and beverage concentrates, but the colloid mill is used in producing all of these. Automobile and furniture polishes, wax and resin paper coatings, jellies, flavorings, vitamin products, various pharmaceuticals and cosmetics, are only a few more of the many emulsions which benefit from treatment in these mills.

The fineness of emulsions or colloidal suspensions depends on the amount of "shearing" which the particles or globules in the mixture receive. Whether this is brought about by sudden violence such as is said to have produced the emulsions found in the oil fields, or to the slow grindings of thousands of centuries which produce the familiar colloidal river muds and clays, is of little moment. Also, it matters little whether the dispersions are produced by hydraulic or attritional shear providing only the amount of shear has been sufficient.

Colloid mills, in the past, have depended for their results almost entirely on "hydraulic shear." By passing materials to be treated between the faces of closely adjusted rotors, or rotors and stators revolving at high speeds, "hydraulic-shear" acts on the agglomerates, oil or fat globules, breaking them up and dispersing them. Because of practical limitations, the areas of the rotor faces have been relatively small. Many different types of rotors have been designed with a view to overcoming this limitation and creating increased rotor area —some attempts having been more successful than others.



Diagrammatic view of a Bartlett-Snow Triple Action Colloid Mill showing—"A" the inlet funnel;—"B" the impellers or vanes on top of the rotor;—"C" the close clearance between the rotor and the housing where the first processing action takes place;—"D" the interlocking rings on the bottom of the rotor and the top of the stator where the second processing action takes place;—"E" the smooth section between the stator and the rotor where the third processing action takes place;—and "F" the chamber through which the material drains to the discharge outlet.

How much of the dispersive action in a colloid mill results from the direct attrition of the rotor face, how much from inter-particle impingement, and how much from "hydraulic-shear," has remained problematical. Although some "grinding" action and reduction of particle sizes has been claimed for colloid mills, several of the foremost authorities on the subject claim that colloid mills do not grind or reduce the size of the particles, but merely disperse the agglomerates.

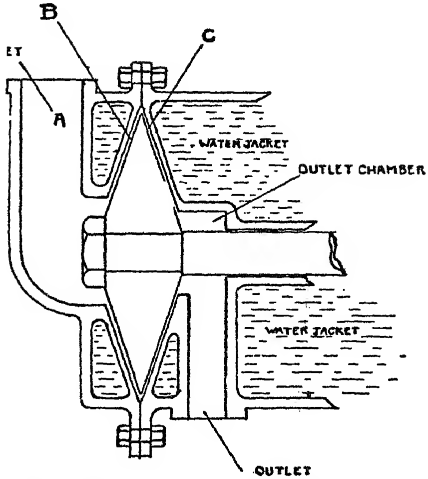
Generally speaking the essential considerations of a colloid mill—listed in order of importance—are:

(1) The efficiency or thoroughness with which the machine disintegrates, disperses, emulsifies or mixes the material, (2) the facility for feeding the machine and for removing the processed material, (3) the ease of disassembly, cleaning, and re-assembly, (4) the absence of packing, glands, etc., (5) low horsepower requirement per gallon of throughput.

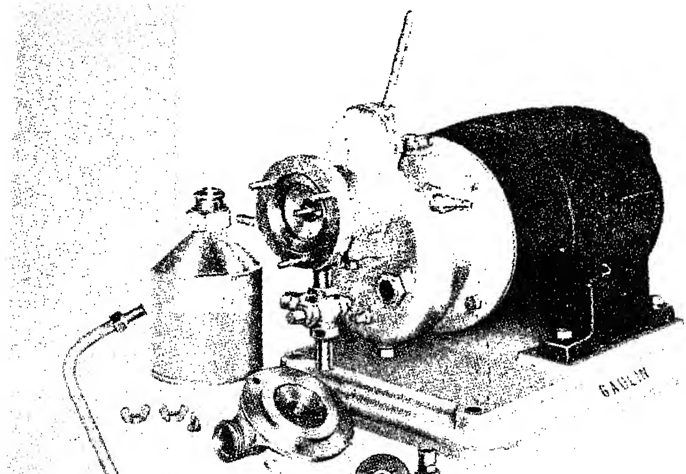
The Manton-Gaulin Colloid Mill

The material to be treated is introduced at A and is forced through the first stage gap B, by impellers located on the front rotor face. These impellers also act as cutters and shredders, breaking down and thoroughly disintegrating the material as it passes through. In this gap the material receives a treatment given by no other mill. The pressure built up by the impellers forces the material across the outer edge of the rotor, then inward across the second stage, or back face C, where it receives another and finishing treatment.

It should be noted that in its passage through gap "C," the product being treated is travelling counter to the path of centrifugal force. This is of extreme importance. Material



The Manton—Gaulin Colloid Mill



Gaulin 2″ Mill Disassembled

in the second stage enters the gap at the periphery, where it covers the maximum rotor area. From here it is crowded and pushed into the diminishing gap area by pressure, and emerges at the center of the rotor, at practically no pressure. In its entire passage through the second, or finishing stage, the material receives the maximum possible rotor action. The second stage "C" is adjustable by means of an adjusting dial which is calibrated in thousandths of an inch. All adjustments can be made while the mill is running.

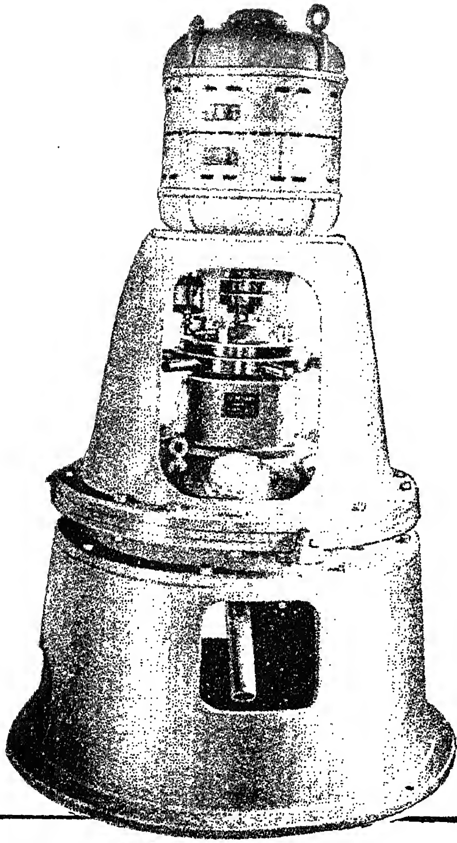
The Premier Colloid Mill

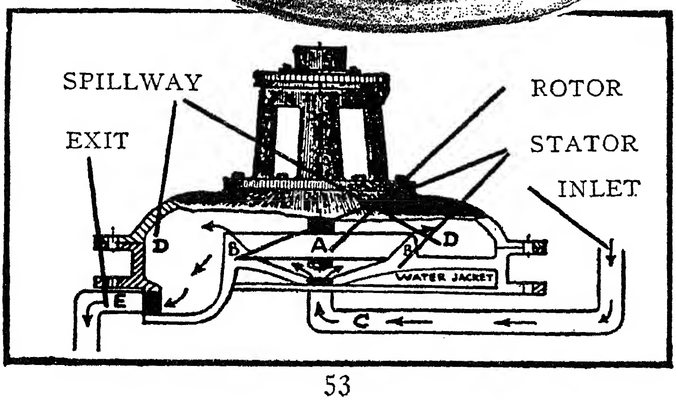
A study of the sectional drawing of the liquid type Premier Colloid Mill shows the material passing through this mill. Entering through inlet (c), passing through the clearance between the rotor (a) and the stator (b), materials are discharged through the spillway (d).

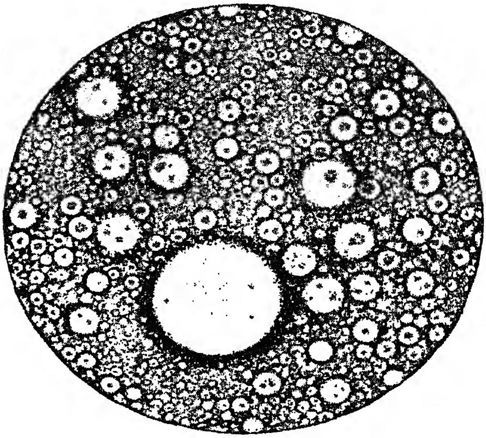
Homogenizers

The process of homogenization consists essentially in passing the product under pressure between ground surfaces. High velocity, hydraulic shear, pressure release and impact rend the disperse phase (or material to be emulsified or dispersed) into a very fine state of sub-division. The particles or globules are reduced to one micron and less in diameter. (One micron is equivalent to approximately 1/25000 of an inch.)

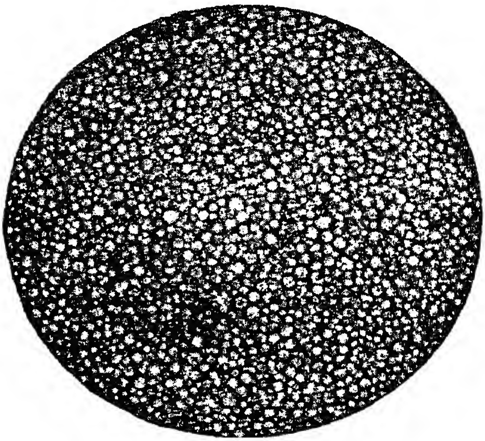
In the homogenizing process, the reciprocating action of a plunger type pump forces the product between the valve seat and the valve. Pressure is applied by a handwheel which restricts the valve gap and the material is forced through by the pressure which is built up. Since the pressure is positive, receptacles on levels much higher than the homogenizer may be filled directly from the discharge pipe.



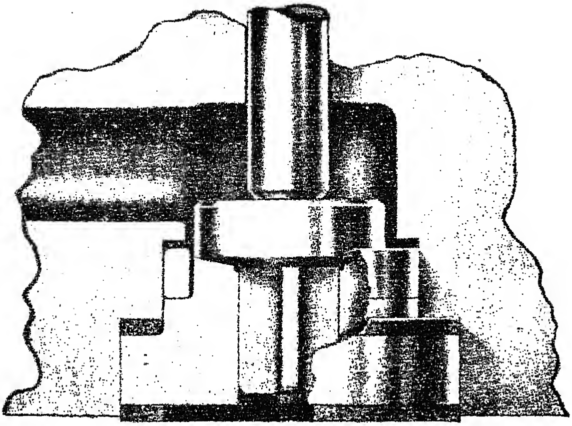

SPILLWAY
ROTOR
EXIT
STATOR
INLET
D
A
D
B
B
WATER JACKET
E
C



Ordinary Emulsion Magnified × 1,000



Same Emulsion Processed through the Premier Mill
Magnified × 1,000



The above illustration shows the homogenizing valve for the Gaulin Laboratory Homogenizer. The valve and valve seat are ground to fit each other perfectly. The valve has a long closely fitted guide or pilot to insure accurate seating.

CHAPTER IV

STABILITY

UNDER the microscope, emulsions appear to consist of small drops of oil suspended in a liquid. The droplets are surrounded by soap pellicles which not only impede their coalescence but also keep them uniformly dispersed. Dilution breaks emulsions because a certain quantity of soap becomes dissociated in the water. The elasticity and toughness of the layer protecting the droplets is of great importance to the stability of an emulsion. These properties are not the same with all emulsifiers. For example, under the same conditions, the pellicle of sodium oleate is much more resistant than that of sodium stearate. The resistance of sodium stearate is even inferior to that of oleic acid alone. When oleic acid soap is added to a colloidal stearic acid soap solution in water, it is the stearate that is dispersed. To make the most stable emulsions, an emulsifying agent is required that will give pellicles which are most resistant to the conditions to which the emulsion must be exposed. It is also necessary that the product to be emulsified, is either a liquid or becomes dissolved during the preparation of the emulsion. It must also be subdivided mechanically into very small particles, the smaller the particles the more stable the emulsion. Other factors in stability are the viscosity of the dispersion, the proportion and solubility of the emulsifier in the dispersing

means, the stability of the emulsifier in the air, with heat, in the presence of acids and salts, and its ability to form elastic and very thin adhesive layers. The specific gravity of the dispersed phase and dispersion medium influences the stability of emulsions. The greater the difference in specific gravity, the greater the tendency for the emulsion to break. The greater the volume of the droplets, the less stable the emulsion. With the same proportions of oil, water, or soap the emulsion may be fluid, or more or less dense, according to the size of the droplets. The addition of a larger proportion of water makes some emulsions more stable and others less stable. The activity of emulsifiers can be increased by adding other colloids like glue, casein or starch, which render the pellicle, surrounding the emulsified substances, more resistant.

The strength and compactness of the interfacial film are the most important factors favoring stability of an emulsion.[1] Most of the other influences are effective only insofar as they modify the properties of the film. Among these subsidiary factors the concentration of the emulsifying agent is significant. The stability of an emulsion of moderately high oil concentration is seriously affected by the addition of electrolytes, only if the amount of agent is insufficient to form a coherent film around the oil globule. The typical stabilized emulsion of the oil-in-water type possesses hydrophilic properties, especially when there is an excess of emulsifying agent, and may be regarded as a combination of and an intermediate between a hydrophilic and a hydrophobic colloid. Although interfacial tension plays a doubtful role in the stability of emulsions, the interfacial adsorption, which accompanies it, is an important stability factor. Viscosity by itself cannot explain emulsion stability, even though vis-

King, Trans. Faraday Soc. *37*, 168 (1941).

cous emulsions are generally more stable than mobile ones; high viscosity is regarded as a symptom rather than as a cause of stability in emulsion systems.

As early as 1923 Finkle[2] suggested that the relative volume of the polar group should play an important part in determining the type and stability of the emulsion. If, e.g., the metal radical in a soap occupies a large volume in the aqueous phase, the close packing will form a surface convex from the aqueous side (hence an oil-in-water emulsion). The larger the volume of the metal radical the more convex the surface will be (hence the smaller the drop and the more stable the emulsion). If the metal is multivalent, the volumes of the attached carbon chains will be relatively larger than that of the metal, and the close packing will make the surface concave towards water (hence a water-in-oil emulsion), and the more concave the surface the higher the valence and lower the volume of the metal. A series of hydrocarbon and water emulsions, with oleates and stearates of cesium, potassium, sodium, calcium, silver, magnesium, zinc, aluminum and iron, showed this type of emulsion and its stability to be consistently correlated with the atomic volumes of the metals. The drop sizes of emulsions containing cesium, potassium and sodium stearates were similarly consistent.

Schulman reports optimal stability of an emulsion of heavy refined mineral oil results if: the interfacial film is electrically charged; the interfacial film is stable and completely covered with charged molecules. Such conditions are met by one phase being oil-soluble and the other ionizable in water. The stability of interfacial films runs similarly to that of the same films at the air-water interface and depends on the Van der Wales forces of attraction between non-polar groups and on the inter-action of the respective head groups.

[2] Finkle, J. Am. Chem. Soc. *45*, 2780 (1923).

Viscosity

Emulsions made with natural colloids (e.g., gelatin, gum tragacanth or egg yolk) are more viscous than those made with soaps. Where excessive dripping or penetration of an emulsion is undesirable, a more viscous emulsion is preferable. In any given formulation it may be assumed that the greater the viscosity, the better is the emulsification providing that all other conditions are satisfactory.

The following formula, developed by Stokes, shows the effect of viscosity on the settling rate of dispersed particles.

$$V = \frac{2r^2(s-s^1)g}{9n}$$

V Rate of settling
r Radius of dispersed particle
s Density of dispersed particle
s^1 Density of liquid phase
g Gravitational constant
n Viscosity of liquid phase

Mathematical formulae for predicting emulsion viscosity have also been given by a number of other investigators.[2]

Increasing the viscosity of emulsions, when necessary, is accomplished by changing the ratio of the phases, increasing the amount of emulsifier, inversion of the emulsion type or the addition of small amounts of specific materials such as alcohols, cresols, eugenol, thymol, carvacol, glycerol, esters, and so forth. If too large an amount of the latter is added breaking may result.

Next to concentration, the stabilizer used seems to be of most importance in determining the viscosity of any phase pair. Stabilizers that give the best emulsions (most readily

[2] Clayton, Theory of Emulsions, p. 130, P. Blakiston Son & Co. (1935); Patrick in Taylor's Treatise on Physical Chemistry, Vol. II, p. 1314, D. Van Nostrand Co. (1924); Monson, J. Ind. & Eng. Chem. *30*, 1287 (1938).

emulsified) also give emulsions of the lowest limiting relative viscosity.[1b]

The viscosity of gelatin emulsions is reduced by hydrolysis on aging or heating and also by exposure to ultrasonic waves.[1c]

Irregular viscosities of the same emulsions are most pronounced when freshly made. Exclusion of air from the emulsion gives similar viscosity.[1d]

Viscosity of emulsions of the same pair of phases (paraffin oil and water with sodium oleate) is not dependent on particle size or size distribution within wide limits. Viscosities of emulsions of the same continuous phase and different disperse phases are almost independent of the disperse phase. The viscosity of emulsions decreases with increasing velocity gradient and is independent of it beyond a certain limit.[1e]

Viscosity of Colloidal Solutions in Presence of Electrolytes

The available data relative to the influence of electrolytes on the viscosity of colloidal solutions appear to show that the viscosity of the solution increases with the thickness of the layer of water covering the colloidal particle, an oil emulsion representing a limiting case. The addition of an electrolyte, in small quantities, increases the potential of the electric double layer at the surface of the particle, whereas, in excess amounts, it diminishes the charge by coagulation. Since the former effect increases the viscosity and latter diminishes it, a minimum on the viscosity-electrolyte concentration curve is anticipated.

In soap and alkali salt solutions the lowering of viscosity by small additions of electrolytes, is due to loss of water by

[1b] Broughton, J. Phys. Chem. *42*, 253 (1938).
[1c] Porter, J. Ind. & Eng. Chem. News Ed. *12*, 748 (1940).
[1d] Narayanaswamy, J. Ind. Inst. Sci. *17A*, 75 (1934).
[1e] Sibree, Trans. Faraday. Soc. 27, 161 (1931).

the colloidal particle, and consequent shrinkage. This loss of waters occurs through osmosis.

On the other hand the lowering of the viscosity may not be due to shrinkage, but to loss of water caused by the increase of charge resulting from the preferential absorption of either positive or negative ions from the solution.

At higher concentrations, coagulation occurs, accompanied by water absorption, and the viscosity increases. If no absorption of water occurs, the viscosity does not increase with coagulation, therefore the viscosity is closely related to the homogeneity of the coagulum.

Colloidal proteins have high viscosities, and contain solid particles that occlude large volumes of water, which can no longer function as solvent. It is very difficult to find a theory of inorganic colloids which covers the facts, but it is suggested that the addition of an electrolyte may cause an increase of cataphoretic potential, with corresponding diminution in viscosity.[1f] The viscosity of natural W/O petroleum emulsions is increased by ferric ions.[1g]

Phase Volume Ratios

The relative volumes of the phases effect the type and stability of an emulsion; e.g., if in making margarine, the milk is run into the large volume of oil, while stirring, a W/O type results.[1a] When the oil is mixed into the milk a O/W type forms.

In emulsions made with soap there is no particular limit to the amount of soap, but the amount of water must vary within a fairly close range to produce a proper hydrating effect and properly orient in conjunction with the soap and

[1f] K. C., Sen Kolloid-Z *38*, 253-7 (1926).
[1g] Sherrick, J. Ind. & Eng. Chem. *12*, 137 (1920).
[1a] Clayton, Margarine J. *2*, 13,503 (1920).
[1b] Brown, Textile Colorist, *57*, 516 (1935).

The shape of the mixing vessel affects the critical amounts of the phases.[1c]

Creaming

Creaming is the separation of a concentrated layer of the disperse phase.

A simple test for creaming, in an opaque emulsion, is to dip a finger in it. If there has been creaming, some of the emulsion will stick to the finger instead of draining off quickly.[2a]

Mathematically it is computed that this cream layer contains 74% by volume of the disperse phase. Creaming is dependent on the relative specific gravities of the oil and water phases. In O/W emulsions, creaming takes place at the top if the oil is lighter than water. If the oil is heavier, the cream forms at the bottom.

The speed of cream formation depends on the specific gravity of the oil, viscosities of both phases, globule size, quantity and solubility of emulsion and a number of other variables.

The velocity, with which a particle of dispersed oil rises or creams, is directly proportional to the difference in density between the oil and water phases and the square of the diameter of the oil particle. It is inversely proportional to the viscosity of the aqueous phase. Thus, if the diameter of the oil particle is reduced one half, a given amount of creaming would require four times the time interval. Emulsions of sufficiently small particle size may never cream, e.g., homogenized milk.

Retardation of creaming is helped by agitation or by the addition of a heavy or light material (as the case may be) to the oil phase. Preferably this addition should be insoluble

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[1c] Crockett, J. Ind. & Eng. Chem. *9,* 969 (1917).

[2a] Brown, Textile Colorist, *57,* 515 (1935).

in the water phase. Thus, in a mineral oil, soap, water emulsion the densities of the phases are equalized by the addition of cresol and creaming is retarded. Similarly, carbon tetrachloride is used to prevent creaming. In W/O emulsions creaming is in the opposite direction to that previously mentioned.[2b]

Hydrophilic Emulsions

Where hydrophilic colloids are used the emulsions have a larger particle size than when soap is used, but are more stable.[3] The former are less affected by addition of an electrolyte and rise of temperature. Their emulsions are more viscous and may even gel. Decreasing this viscosity tends to decrease stability.

The efficiency of an emulsifying agent is due to its ability to form a strong solvated membrane at the oil-water interface. Thus, agents which gel readily form strong membranes, giving stable emulsions.

Where gums are used, high viscosity emulsions are formed. This indicates that much of the gum does not remain at the interface, but is in the dispersed phase. Although this produces a coarse emulsion, it favors stability because creaming and agglomeration of oil particles caused by kinetic impact are greatly reduced.

Hydrophilic emulsifiers, that do not form gels, form a fine particle size emulsion, but because of the low viscosity of the continuous phase, relative instability results. This low viscosity is due to the fact that no solvated membranes are formed, and there is less tendency to form an oriented adsorbed layer than when soap is used.

Deterioration of hydrophilic stabilized emulsions, which

[2b] Modern Cosmeticology. Harry p. 7. Chemical Publishing Co., Inc., Brooklyn, N. Y.

[3] J. Soc. of Chem. Ind. *59,* No. 9, 185.

appear stable when made, is often caused by the gradual growth of the droplets of the dispersed phase, without actual separation. Lecithin, however, acts more like soap in this respect, i.e., showing an oil separation on aging.

Tragacanth stabilized emulsions of vegetable and mineral oils are especially stable between pH 1.9 and 2.3. Acacia has stability range between pH 2–10 and shows a higher dispersion.

A stable emulsion is one in which there is no separation or concentration of phases as evidenced by formation of oil droplets coalescing to form an oil or water layer, and no creaming due to concentration of the dispersed phase.

Homogenized soap emulsions of oils deteriorate not by gradual globule size increase, but by distinct oil separation.[4] All globules larger than 7.5u are essentially unstable.[1] Similar emulsions, made by shaking, are coarser with the initial size of the globules being greater than 7.5u. These globules grow by coalescing without separating free oil.

The particle size of emulsions varies within wide limits. In transparent emulsions the particles are smaller than the wave length of light (less than 10^{-5} cm.). Bluish milky emulsions are composed of particles of the size of 10^{-4} to 10^{-5} cm. White emulsions contain particles 10^{-4} cm. and larger.

Thus, the transparency or color of an emulsion indicates the particle size and in some cases is an indication of stability and certain physical characteristics.

The stability of an emulsion can be predicted if the size distribution of the globules is known.[5] The method of determining distribution (size-frequency) is as follows: the emulsion is diluted with an equal amount of strong gelatin solution. This is examined at about 1100 diameters through the

[4] Billings, Amer. Dyestuff Rept. p. 267 (May 1938).

[5] Technical Aspects of Emulsions, p. 52, 53, Chemical Publishing Co., Inc., Brooklyn, N. Y.

microscope. The approximate size of the globules is determined with a squared eye-piece, calibrated by means of a stage micrometer. Counts of various size groups are made and compared with counts of similar emulsion samples. To keep errors at a minimum, at least 1000 globules are measured and counted, using at least two slides and several non-contiguous fields on each slide. It is also necessary to vary the focus so as to examine different depths of the film.

In storing emulsions care should be taken to prevent evaporation which will cause deterioration. Change in composition due to chemical interaction between the ingredients or with the container may also cause break-down.

In the preparation of emulsions by use of a hand homogenizer, a mixture of acacia and tragacanth (3:1) gives better results than either gum alone. The mixture of gums gives emulsions that are whiter than those made with tragacanth alone, and shows less creaming than those made with acacia alone. These results hold true for cod liver oil, linseed oil and mineral oil but not for castor oil. The use of tragacanth in combination with acacia is of no advantage if the emulsions are made with a mortar and pestle. From the results of viscosity tests, it appears that the beneficial results obtained by addition of tragacanth in certain cases, are due to factors other than viscosity alone.

When using gelatin, pH is also a very important consideration.[7] The electrical charge, as well as the protective membrane of gelatin formed on the droplets, determines the stability. At low emulsifier concentrations the electrical charge becomes an important factor. Changes in stability of gelatin-stabilized emulsions at various pH values are related to changes in surface tension and viscosity of gelatin sols with changing pH.[8]

[7] Technical Aspects of Emulsions, p. 112.
[8] Limburg, Rec. Nav. chim. *45*, 772,854,875 (1926).

A benzene emulsion, stabilized with gelatin at its iso-electric point (when surface tension and viscosity is lowest), showed the greatest stability. Correlated data[9] does not indicate that in emulsions of this type the electrical charge is an important factor. Gelatin emulsions will vary because of variations in the gelatin and because many are not made at a uniform pH.

Saponin stabilized emulsions are very sensitive to calcium, whereas gelatin stabilized emulsions are not broken by calcium chloride. Agar and lecithin stabilized emulsions are coarsened and show lower stability when treated with calcium chloride. It appears that emulsions made with hydrophilic colloids which give the greatest viscosity are more stable to calcium ions. The addition of small amounts of acid has a similar effect.[10]

Thus, emulsion films can be stabilized and toughened by these and other various additions. So, the addition of a small amount of sodium sulfate to a kerosene emulsion with gelatin increases stability.[11] Sodium silicate is likewise helpful in certain soap emulsions.

Octane emulsions with certain soaps are less stable when freshly made.

Benzene emulsions made with soap are adversely affected by addition of oleic acid to the oil phase or alkali or salt to the aqueous phase.[12]

Inversion and then instability results when univalent cations equal to those of the soaps are introduced.[13]

For benzene, toluene and xylene, potassium oleate is a better emulsifier than sodium oleate. Sodium chloride breaks these emulsions more readily than potassium chloride. Sta-

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[9] J. Amer. Chem. Soc. *53,* 2898 (1931).
[10] J. Russ, Phys. Chem. Soc. *59,* 1061 (1927).
[11] Introductory Colloid Chemistry. Holmes p. 75 (1934).
[12] Harkins, Fifth Colloid Symposium Monograph. p. 19 (1928).
[13] Tartar, J. Phys. Chem. *33,* 435 (1929).

bility of xylene emulsions with soap is improved by phenol or its derivatives.[14]

The addition of certain amounts of chloroform stabilizes electro-negative colloids but not those that are electro-positive.[15]

Glycerin stabilizes oil emulsions with soap and Irish moss.[16]

Gum acacia stabilizes oil emulsions with soap.

Water-oil emulsions may be stabilized with a dammar solution.[17]

Stability of olive, castor, and cod liver oils is increased by a little free fatty acid, using caustic soda as the emulsifier. W/O emulsions of these oils with calcium and barium hydroxide are coagulated by excess alkali.[18] Emulsification is favored by the addition of gelatin or gum arabic.

Emulsions containing free alkalies, that may be stable when made or kept in air-tight containers, develop a scum on the surface due to absorption of carbon dioxide and begin to break at the surface. A critical temperature exists below which no scum forms.[19]

Precipitates in emulsions may be due to excess of a sparingly soluble ingredient or the formation of an insoluble reaction product, e.g., a lime soap formed from dissolved calcium compounds and soap. Such reaction products may form slowly, but will definitely effect stability.

In W/O emulsions, containing coal particles, the latter are held in suspension at the water oil interface. The coal particles tend to displace the emulsifier and break the emulsion.[20]

Stability may be increased by proper adjustment of ion

[14] Viekhhertz, Colloid J. (U.S.S.R.) *2,* 133.
[15] Sabbatini, Atti. 1st Veneto *87,* 321 (1927).
[16] Crockett, J. Ind. & Eng. Chem. *9,* 969 (1917).
[17] Holmes, U. S. 1,429,430 (1922).
[18] Iselin, Boll Chim. farm. *67,* 225 (1928).
[19] Davey, Phys. Rev. *11,* 138 (1918).
[20] Hedrick, Ind. Eng. Chem. *33,* 1057 (1941).

adsorption. Hydrogen ion adsorption in phenol water emulsions is an example.[21]

Very acid sulfonated vegetable oil gives stable mineral oil emulsions of pH 5.8–9.0. Sulfonated cod oil gives stable emulsions only at pH 7.8 to 12.0. These emulsions dilute readily and are broken by more than 3% salt.[22]

A mixture of alizarin oil and spindle oil gives an emulsion, the stability of which increases (pH 6.9–7.0) with the increase of alizarin oil (from 10 to 40%). A mixture of sulfonated train oil and spindle oil, in general, gives more stable emulsions than a similar mixture with alizarin oil. The stability of a 5% emulsion of a mixture containing 50% spindle oil, 40% sulfonated train oil and 10% sulfonated petroleum increases with the increase in the pH. The stability of these emulsions is not affected by temperatures within 20–40°.[23]

Vegetable and mineral oil emulsions prepared with gum acacia are stable between pH 2–10. Changes of pH do not affect the relative viscosities or surface tensions of these emulsions. Alkalies are detrimental. Such emulsions made with gum tragacanth are most stable at pH 1.9–2.3 and are unstable when alkaline. They also change in particle size and viscosity with change in pH. Stability decreases with increase in particle size.[24]

For some purposes a quick breaking emulsion is desirable, as in agricultural sprays. Here the emulsion should break as soon as possible after application to the plant, and thus release the active ingredient. Such quick breaking emulsions are usually unstable and are made up just before use. Quick breaking emulsions usually contain an insufficient amount of emulsifying agent.[25]

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[21] Ellis, Z. phys. Chem. *80,* 597 (1912).
[22] Woodroffe, J. Inter. Soc. Leath. Trades Chem. *12,* 419 (1928).
[23] Pehelin Tz. Nauch. Sbornik Rabot *4,* 111 (1934).
[24] Krantz, J. Amer. Pharm. Assoc. *15,* 83, (1926).
[25] Technical Aspects of Emulsions, p. 73.

An emulsion may be stable in W/O type and may become unstable due to inversion caused by shaking in transit. Instability of soap emulsions by inversion of type because of dilution with hard water and formation of lime soaps,[26, 27] is also common.

The stability of mayonnaise is increased by the incorporation of finely divided mustard powder.[28]

The thickness of the emulsifier interface is one of the criteria of stability. The initial concentration of emulsifier at the interface is not the minimal amount necessary; the important factor being the concentration after adsorption has taken place.[29] An emulsion of globules protected by an expanded film is unstable. A compact, oriented, monomolecular film gives greater stability.[30] The greater the resistance of this layer to rupture, the greater the stability of the emulsion.[31] Soap films tend to be monomolecular, either attenuated or compact.

If the emulsifying agent is peptized too much, by the continuous phase, it will not form a protective film at the interface and an emulsion may not form. This is the case when hydrous ferric oxide is used to make a benzene-water emulsion. If a little dilute sodium chloride solution is added, a crude emulsion is formed.[32] A slight increase in salt produces greater stability.

A certain type of mechanical treatment may break as well as make an emulsion. Thus, if the droplets formed travel in parallel lines at different velocities along too great a distance, orthokinetic coagulation takes place.

[26] Ibid., p. 94.
[27] Ibid., p. 95.
[28] Ibid., p. 96.
[29] Fischer, J. Phy. Chem. *36*, 98 (1932).
[30] Markins, J. Amer. Chem. Soc. 51, 1674 (1929).
[31] Technical Aspects of Emulsions, p. 112.
[32] Briggs, Ind. & Eng. Chem. *13*, 1008 (1921).

The stability of a delicate emulsion in a closed container is affected by the enclosed air in two ways; by mechanical means, and by changes in concentration through vaporization and condensation due to temperature changes.[33]

Many emulsions are broken by freezing. Freezing breaks them by destroying the membrane of emulsifier surrounding each globule, rather than by the mere freezing of the continuous phase.[33a]

Some emulsions can be frozen solid and thawed without breaking. Supercooling without actual freezing is often possible, but freezing usually results in breaking. On freezing and thawing, with resultant breakdown, the emulsifier may disappear from the water phase.[33b]

Heat may produce profound chemical or physical changes which may break an emulsion. Heating of emulsions made with hydrophilic agents usually increases globule size. Agar stabilized emulsions break at temperatures above the gelling point of agar dispersions. Lecithin emulsions are, however, less affected by heat.

For this reason, heat is only used to render a very viscous or solid phase fluid. In the latter case, the water phase should be heated to about the same temperature, to avoid chilling and solidifying the solid phase. No higher temperatures should be used than are necessary.

Aging decreases specific interfacial area. This decrease is greater with natural colloids than with soap. Initial size frequency analysis of the former is not necessarily indicative of stability, i.e., a finely dispersed emulsion of the former is naturally less stable than a coarsely dispersed emulsion.

Time shows the effects of very slow chemical reactions as changes of state. Similarly sedimentation or separation,

[33] Nagelstein, Kolloid-Z-*83*, 224 (1938).
[33a] Rochow, Ind. & Eng. Chem. *28*, 1926 (1936).
[33b] Technical Aspects of Emulsions, p. 146 (1936).

because of the difference in density, may become evident on aging.

Oil emulsions with Irish moss are broken by a trace of soap. Addition of a little glycerol prevents breaking. Larger amounts of soap aid emulsification. Better emulsions result when all the water is added at once to the mixed oil and Irish

Causes of Instability

Many persons are completely at sea when a preparation separates. The causes of separation are not so numerous. Some of them, of course, are due to physical reactions about which little is known. Among the causes encountered are:

DECOMPOSITION: This usually occurs when mucilages, albumen and animal products are used as emulsifying agents, and is due to the lack or an insufficiency of preservative.

INCOMPATIBILITY: This occurs when the emulsion contains an ingredient which is incompatible with the emulsifying agent and causes it to precipitate, e.g., borax in an emulsion containing gum acacia; mineral acids in emulsions containing albumen. Another very common instance of incompatibility occurs in connection with an attempt to make an acid emulsion with a soap emulsifying agent.

INSUFFICIENT DISPERSION: This is due to failure to reduce the oil globules to a very minute size. This is a deficiency caused by lack of adequate equipment or proper technique. There are any number of emulsions that will separate on standing when mixed in the ordinary way but will stand up indefinitely when mixed properly as, for instance, in a colloid mill or homogenizer.

EXCESSIVE DISPERSION: This is the reverse of the foregoing and is due to such fine dispersion that the properties of

[34] Crockett, J. Ind. Eng. Chem. 9, 967 (1917).

the emulsifying agent are destroyed. This condition frequently occurs in connection with preparations containing vegetable mucilages, which should be mixed at low speeds with a paddle type mixer.

ELECTROLYTES: The presence of salts especially those of calcium, magnesium, aluminum, copper, iron, zinc, bismuth, mercury, are likely to destroy emulsions, but in some instances very small quantities can be added after the emulsion has first been formed.

TEMPERATURE: Numerous emulsions will break if exposed to low temperatures; others will break if exposed to high temperatures. Emulsions containing soap are likely to be sensitive to cold; those containing animal products are likely to be sensitive to heat. Sometimes, a temperature variation of twenty degrees one way or another will cause separation, as for instance, when emulsions are heated by attrition in going through a colloid mill, or by pressure in a homogenizer.

INSUFFICIENT VISCOSITY: Many emulsions will separate if not sufficiently viscous. This can be remedied by the addition of a thickening agent that will raise the degree of viscosity.

IMPROPER PROCEDURE: Some emulsions must be mixed slowly; others must be mixed rapidly. Some will require the making of a primary emulsion first which can be diluted after emulsification has been effected. Chemicals like phosphorus, sulphur, camphor, creosote, cannot be added to the batch directly but if first dissolved in a fixed oil, can be emulsified very readily.

FAILURE TO DISTINGUISH TYPES: Attempts to add water to water-in-oil type emulsions or oil to oil-in-water types will cause separation. Many fail to distinguish between these two emulsion types. They assume that because the emulsion contains more oil than water they can add more oil to it, whereas

an emulsion can consist of ninety per cent oil and ten per cent water and still be an oil-in-water emulsion.

IMPROPER EMULSIFYING AGENT: No one emulsifying agent is suitable for all emulsions. The user should know what emulsifying agents are best for his particular emulsion. Often a stable emulsion can be secured by changing its type, that is from oil-in-water to a water-in-oil, an effect which can be accomplished by changing the emulsifying agent.

Summary

Emulsion instability may be caused by:

Improper ratio of oil and water phases.
Incorrect amount of emulsifier.
Impurities in oil or water phases or emulsifier.
Reaction between two or more components and/or container.
Overheating
Excessive evaporation
Freezing
Mechanical shock or vibration
Improper balancing of densities
Time of mixing
Absorption of gases or foreign particles.

Testing Stability of Emulsions

a. The quickest way of testing stability is to use a small laboratory centrifuge. Put the samples in tubes and keep a record of the time required to break them as against a known standard. In order to see how emulsions will resist cold, put samples into a refrigerator and keep the temperature around the freezing point for a couple of days. To check heat resistance put samples into a thermostatically controlled electric oven and keep them there for a couple of days at a constant temperature of 110°F.

b. A glass cylinder 25 millimeters in diameter with a

bulbous extension at the bottom is fitted with a side cock and rests in a wooden support. The cylinder is charged with 100 cubic centimeters of the emulsion and placed in a drying oven to settle at a definite temperature and for a definite time. After 20 cubic centimeters of the liquid has been removed and discarded, 10 cubic centimeters is withdrawn into a tared aluminum beaker and weighed before and after evaporation into a drying oven, giving the moisture content. If the emulsion contains B per cent of dispersed, and *a* is the percentage of the dry substances of the phase, and *b* the weight of the evaporated moisture, then the content of non-fatty part in the emulsion is:

$$b(100+a)/a$$

and the stability of the emulsion is: [36]

$$b(100+a)/B$$

c. Two copper plates are kept apart by 2 pieces of glass of about 0.2 millimeter thickness with a rubber band around the whole. The breaking of an emulsion is indicated by the glowing of an electric lamp of 50 candle power with alternating current of 120 volts and 50 cycles passing through the electrodes and the emulsion at 40–50°.

The efficiency of various methods of preparation of emulsions and emulsifying agents is shown by different stabilities of the emulsions.[37]

A finer W/O emulsion of vegetable oil with milk, salt, (margarine) is made by supercooling before adding the emulsifier.[38]

Attempts to homogenize an emulsion containing more than 74% of oil (the disperse phase) resulted in the production of

[36] Bochko, Maslo. Zhiro. Delo. *11*, 489 (1935).
[37] L. Pick, Chem. Obzor *3*, 202-3 (1928).
[38] Newton, U. S. 2,232,401 (1941).

a new emulsion containing approximately the volume of oil required for the globules to be in the closest packing when of uniform diameter. Microscopic examination of the new emulsion produced by homogenization showed that the globules were small and of almost uniform diameter. It was very difficult to increase the oil content of such an emulsion even with additions of 1 cc. of oil and shaking after each addition. Emulsions containing less than 72% of benzene or 70% of toluene (the two compounds used in the experiments) did not show any tendency to decompose on being passed through the homogenizer, but instead in every instance, an emulsion of greater stability was produced.[89]

The stability of water-gas tar emulsions, in which water is the dispersed phase, is increased as the completeness of oil cracking is decreased and is affected both by the condensing and cooling methods and the quality of the tar itself. Usually the tar which condenses from the gas, in the early stage of cooling, forms the most stable emulsions. The free carbon of the tar is the emulsifying agent causing the production of emulsions, its effect however, not being the same for each of the oil constituents of the tar. In ordinary operation the most stable emulsions are formed of those tars which contain the largest percentage of saturated oils. The optimal per cent of carbon for the formation of stable emulsions varies with the oil and the tar; if present beyond this amount, there is a distinct tendency for the agglomeration and separation of the water with the formation of tar-carbon amalgams suitable for fuel. The amount of carbon to be added depends primarily upon its fineness of division. The rate of separation of water by settling or otherwise is not the same in different emulsions, but is dependent on the temperature of the emulsion, specific gravity and composition of the tar, soluble con-

[89] Parke, J. Chem. Soc. 1458 (1933).

stituents in the water, size of the dispersed water droplets, and other variables.[40]

Preparation of carron oil revealed the following: (1) The oils which yielded the most stable emulsions were olive, sesame, rape-seed and apricot kernel. Corn, cottonseed and linseed oils gave inferior emulsions.[41]

Emulsion breakdown in oil-in-water type creams is often caused by the use of insufficient emulsifying agent, by the manner in which the constituents are incorporated, by the use of an oil that is too light and by the reaction between the emulsifying agent and other constituents in the preparation. In the case of liquid beeswax-borax emulsions, more stable products may be secured by the addition of Castile soaps or a gum mucilage, such as quince-seed, or such emulsifying agents as glycol stearate or oleate, and so forth. Breakdown in water-in-oil types is caused by heat, chemicals, incompatibilities, lack of homogeneity, insufficient emulsifying agent and improper selection of waxes as hardening agents.[42]

The presence of a gas is an important factor in the stability of some emulsions. When certain liquids are freed from gas as completely as possible, and emulsification is attempted in a vacuum, no emulsion is produced, whereas introduction of a gas will yield a good emulsion. Air, as well as inert gases, may serve in this stead. It may be that thin layers of gas envelop the droplets and retard or prevent coalescence, e.g., emulsions of paraffin oil and toluene containing a gas are formed more easily and are more stable than if no gas is present.[43]

A difference of potential exists between the dispersed and the continuous phases. A difference of about 0.06 volts affords a fairly stable emulsion. When it becomes zero, the

[40] Odell, Bur. Mines, Repts. Invest. *2331,* 5 (1922).
[41] Langenhan, Prac. Druggist. *42,* 25 (1924).
[42] Deakers, Drug Cosmetic Ind. *43,* 36 (1938).
[43] Rogowski, A. Pysik, Chem. A 166,428 (1933).

emulsion breaks—a point called the isoelectric point. The critical potential is the point, before the isoelectric point, at which the breaking of the emulsion starts. Electrolytes sometimes aid greatly in stabilizing certain emulsions.[44]

Breaking Emulsions

In certain cases, it is necessary to break emulsions, e.g., (the production of butter from milk by churning). While some can be broken easily by heat, cold, electrolytes, and mechanical means, others are very resistant to breaking and must be handled in diverse ways. Cost is also an important factor which must be taken into consideration.

To decrease the stability or break an emulsion a substance should be added which breaks the film of the emulsifying agent or tends to reverse the emulsion type, e.g., calcium chloride, which inverts an emulsion made with egg yolk and breaks those made with saponin.[45]

As an example of chemical breaking we can take an emulsion of benzene in water, stabilized by gelatin. It is de-emulsified by a sodium hydroxide solution. If the sodium hydroxide is added immediately after emulsification the separation of benzene commences at once, whereas if the emulsion is left undisturbed for some time before the sodium hydroxide is added, the separation is inhibited for a certain period. This period of inhibition is shown to be a parabolic function of the age of the emulsion. The limiting value found for this period varies directly with the concentration of gelatin used as stabilizer over the range noted from 5 minutes in case of 0.1% to 75 minutes for 0.4% gelatin. In all cases the system was 50% by volume of benzene, and the de-emulsifier used was 0.5 normal sodium hydroxide. It is suggested, by way of explanation, that after emulsifying, the gelatin slowly forms

[44] Steik, Amer. Dyestuff Reptr. *25*, 429 (1936).
[45] Berkman Egloff, Emulsions and Foams, p. 4 (1941).

protecting layers until equilibrium between the gelatin sol and the adsorbed gelatin is reached.[46]

O/W emulsions are broken by many mechanical means. Milk is frothed by introducing inert gas and the cream is separated by a sieve.[47] Butter is separated by boiling milk at a low temperature in vacuo.[48]

Cream is churned in thin layers exposed to vibrational effects.[49] Wool fat is recovered from emulsions by foaming.[50, 51] Emulsions stabilized by proteins can be broken by shaking, heat or chemical denaturants.[52]

W/O emulsions can be broken by such mechanical means as gravity separation;[53] circulating against baffles[54] or oscillating plates,[55] heating[56] and heating under pressure,[57] or by using solids, preferably wetted.[58] Tar emulsions are broken with finely divided inorganic powders;[59] petroleum emulsions are forced through infusorial earth wetted with oil,[60] through sand, silica, alumina[61] or porous diaphragms.[62]

46 Nugent, Trans. Faraday Soc. Oct. 27, 1921.

47 Ger. 314,090 (1918).

48 Brit. 333,233 (1929).

49 Perks, Brit. 322,416 (1929); U. S. 1,791,000 (1931).

50 Broadbridge, U. S. 1,505,944 (1924); Karpinsky, Brit. 177,498 (1922); Bailey, U. S. 1,770,476 (1930).

51 Brit. 328,606 (1928); U. S. 1,853,871 (1932); Ger. 546,231 (1929).

52 U. S. 1,728,011 (1930).

53 Barber, U. S. 1,945,766 (1934); Edwards, U. S. 1,968,131 (1934); Mahone, U. S. 1,940,726 (1933); Pink, U. S. 1,698,002, 1,698,067 (1929).

54 Fisher, U. S. 1,942,794 (1933).

55 Palmer, U. S. 1,781,076 (1930).

56 Novotney, U. S. 1,968,614 (1934); Turner, U. S. 1,948,481 (1934); Brady, U. S. 1,754,079 (1930); Moseicki, U. S. 1,710,374 (1929).

57 Champion, U. S. 1,943,367-8 (1934); Dubbs, U. S. 1,123,502 (1915); Elliott, U. S. 1,928,282 (1933).

58 Brit. 26,228 (1908).

59 Robinson, Brit. 268,547 (1926); Roth, U. S. 1,665,189 (1928).

60 Zoul, U. S. 1,501,877 (1924).

61 Van Loenen, U. S. 1,944,479-80 (1934); 1,967,601 (1934); Garrison, U. S. 1,947,709 (1934); Eddy, U. S. 1,807,833 (1931); Pollock, U. S. 1,847,413 (1932).

62 Trumble, U. S. 1,304,124 (1919); Haseman, U. S. 1,914,665 (1933).

In the laboratory one of the following methods usually succeeds in breaking emulsions: (1) addition of excess of the solvent in the dispersed phase, (2) addition of a third solvent miscible with each of the other two, (3) destruction of the emulsifying agent, (4) salting out, (5) filtration, (6) heating, freezing or electrolyzing, (7) centrifuging.

If the emulsion is present only as a broad layer at the interface between the two phases, it is best to draw off the emulsion separately and break it.

Examples: (1) If the emulsion is one between ether and water, take a small sample in a test tube and add successive portions of water; if unsuccessful, take a second sample and add ether. (2) A small addition of alcohol breaks an emulsion between ether and water. (3) An emulsion stabilized by soap may be broken by adding acid. (4) Formaldehyde breaks emulsions stabilized by proteins. (5) Anhydrous sodium sulphate, ammonium sulphate, or calcium chloride often salt out emulsifying agents. (6) Filtration breaks emulsions stabilized by flocculent precipitates.[63]

Underground water often forms troublesome emulsions in petroleum fields. The stability of these emulsions varies considerably.[64] The amount of water in these emulsions ranges from a trace to more than 60% (average 25%).

The processes for breaking such emulsions include filtration, evaporation, high voltage alternating currents, direct currents,[65] centrifuging and chemical treatment.[66]

[63] Walter Weinberger, Am. J. Pharmacy *102,* 594-5 (1930).
[64] Sherrick, Jol. Ind. & Eng. Chem. *12,* 133 (1920).
[65] Cottrell, U. S. 987,114 (1911).
[66] Sherrick, Jol. Chem. Soc. *67,* 63 (1895).

CHAPTER V

GENERAL TECHNICAL EMULSIONS

Chemical Activity

WHEN emulsified, water insoluble products are subdivided into very small particles which present a tremendous oil-water interface. This greatly enlarged area of contact with a reactant may greatly speed up the reaction.

When drying oils are emulsified they oxidize and dry more rapidly. Emulsions of some oils are hydrogenated by cultures of hydrogen producing bacteria.[1] Petroleum cracking is furthered by suitable heating of an emulsion of petroleum.[2] Synthetic rubbers are made by polymerization of dienes in emulsion.[3] Vegetable oils, in emulsion, are vulcanized by sulfur.[4] Pigments for latex compounding are protected by wax emulsifiable coatings.[5] Emulsions of heavy liquid hydrocarbons are used in making gas.[6] Liquid fuels are made from emulsions of petroleum oils.[7] Shock absorbing fluids may consist of an emulsion of lard or mineral oil and soap.

[1] Van der Heide, Ger. 482,919 (1926).
[2] Dubbs & Morrell, U. S. 1,744,109 (1930) ; U. S. 1,970,996 (1934).
[3] Ind. Eng. Chem., *25*, 1338 (1933).
[4] I.C.I. Ltd., Brit. 313,252 (1928).
[5] Crawford & Schoenfeld, U. S. 1,191,775 (1933).
[6] Gas Fuel Corp., Fr. 744,602 (1933).
[7] Vance, U. S. 1,926,071 (1933).

Many syntheses require contact between an aqueous and a water insoluble phase. The speed and completeness of a reaction are dependent on intimate contact of the reactors. Amines are made by emulsifying alkyl halides with alcohol, water and soap and allowing this to react with ammonia.[9] Alcohols and glycols are made by emulsifying alkyl chlorides with aqueous sodium oleate.[10] Ethylene dichloride is readily hydrolyzed if it is emulsified in water with ammonium linoleate.[11]

Acrylonitrile is polymerized while emulsified with dilute oleate.[12]

2, 4-dibromo, 2-methyl-butane is hydrolyzed to methyl isopropyl ketone in 80% yield by refluxing with water while stirring, and adding Twitchell's reagent or Gardinol until the solution is clear.[12a]

Nitration of p-cymene is accomplished by using an emulsion made with "Aquasol" or "Sulfatate." [13]

The effect of emulsification on the rate of hydrolysis of amyl acetate, in alkaline solution, was determined by using several emulsifying agents. The rate was increased more than 700 times, but was not proportional to the area of the interface when different agents were used. Experiments were made on other reactions between immiscible liquids; in each case the emulsified system reacted more quickly than the corresponding unemulsified but agitated system.[14]

The penetrability of fat liquor emulsions, important to the leather industry, is discussed by Stiansy and Arnoldi.[15, 16]

[9] Barbieri, U. S. 2,078,555 (1939).
[10] Ayres, J. Ind. & Eng. Chem. *21,* 902 (1929).
[11] Bennett, J. Ind. & Eng. Chem. *22,* 1256 (1930).
[12] I.G., Fr. 845,661 (1940).
[12a] Rozwa, Cologne. Bull. Soc. Chim. *3,* 501 (1936).
[13] Kobe, Ind. & Eng. Chem. *31,* 262 (1939).
[14] King, J. Soc. Chem. Ind. *57,* 431 (1930).
[15] Stiansy, Collegium p. 230 (1928).
[16] Arnoldi, Collegium p. 292 (1928).

It may be found advantageous, in industry, to apply an oil or related substance in the form of an emulsion in the following instances: when the material occurs naturally as an emulsion; when applying oil in water containing mixtures in which, after elimination of the water, the oil must act as a water-repelling agent; when a comparatively small quantity of viscous oil is to be distributed over a large surface; when a highly viscous oil is to be used in cases where it is impossible to apply heat; when by using an emulsion a final product of special properties is obtained; when the large total surface of the emulsified oil is an advantage; and when the charge on the colloidal particle can be used for electro-deposition.[17]

Oil-water emulsions of high oil content are poor conductors of heat.[18]

Agricultural sprays are usually O/W emulsions. Those used for killing insects are known as insecticidal sprays; those for insect eggs are termed ovicidal sprays.

The most commonly used oils in agricultural sprays are mineral and coal tar oils and their derivatives. In certain special cases fixed or essential oils are employed. Since most plants are injured by these oils it is necessary to apply them in a highly diluted form. Dilution with a cheap medium is desirable from the economic standpoint. Water plus an emulsifying agent does this very nicely. This type of emulsion must be O/W so that it can be further diluted in the field, and so that the more active ingredient may remain in the internal phase.[1]

In 1868 an emulsion of cresylic acid, soap and water was first described.[2] In chronological order the following agricultural emulsions were made known: kerosene and whale oil

[17] Eilers, Chem. Weekblad. *35*, 129 (1938).
[18] Pickering, J. Chem. Soc. *21*, 2001 (1907).
[1] Woodman, J. Physical Chem. *33*, 88 (1929).
[2] T. A. Gardeners Monthly (Eng.) p. 11 (Jan. 1868).

soap;[3] kerosene and soft or hard soap;[4] kerosene and milk;[5] heavy tar-oil.[6]

Compound oil sprays containing fungicides introduce the problem of compatibility,[7] e.g., emulsions containing Bordeaux mixture;[8] nicotine;[9] nicotine sulfate;[10] lead arsenate;[11] polysulfides;[12] miscellaneous sprays.

These emulsions are made with cresol soap;[13] sodium resinate;[14] creosote and caustic soda;[15] carbon tetrachloride and cresol soap;[16] tar distillate and rosin soap;[17] fatty acids and glue;[18] pyrethrum extract.[19, 20]

Weed killers, of the W/O type, are intended to kill wherever they contact plant life.[21–24] All other agricultural emulsions are O/W.

Asphalt Emulsions[1]

Bentonite is widely used in the manufacture of asphalt emulsions, which should be more correctly described as "aqueous dispersions" of asphalt.

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[3] Cruickshank, Ibid. 45, (Feb. 1875).
[4] Cook, Mich. Agric. Exp. Sta. Bull. No. 58 (1890).
[5] Lodeman, The Spraying of Plants, p. 153 (1902).
[6] Del Gueres, F. Pflanzenkrakh *4,* 4, (1894).
[7] P.C.
[8] Ginsburg, J. Econ. Entom. 26,566 (1933).
[9] Headlee, N. J. Agric. Exp. Sta. Bull. *469* (1929).
[10] Newcomer, U. S. Dept. Agric. Tech. Bull. *281* (1932).
[11] Batchelder, J. Econ. Entom. *24,* 1152 (1931).
[12] Tower, U. S. 1,869,562 (1932).
[13] Woodman, J. Pomol. Hort. Sci. *4,* 78 (1925).
[14] Penny, J. Econ. Entom. *14,* 428 (1921).
[15] Agric. Gaz. N.S.W. *35,* 290 (1924).
[16] Takashima, J. Pub. Hlth. Japan. *3,* 1 (1927).
[17] Hartzell, N. Y. Agric. Exp. Sta. Bull. *636* (1933).
[18] Staniland, Long Ashton Ann, Report p. 78 (1926).
[19] Lodeman, The Spraying of Plants, p. 78 (1902).
[20] Ginsburg, J. Econ. Entom. *28,* 599 (1932).
[21] Pipal, Indiana State Bull. *176* (1914).
[22] Woodman, Chem. News. *144,* 21 (1932).
[23] Woodman, J.S.C.I. *60,* 91T (1931).
[24] Johnson, Calif. Agric. Exp. Sta. Bull. *528* (1932).
[1] Amer. Colloid Corp., Chicago, Ill.

The usual commercial process [2] is to make a bentonite-water paste or gel, which should be as thick as the stirring or mixing mechanism will permit. This will be about 10 to 12 parts bentonite to 90 parts water. A stiff bentonite paste is desirable in mixing the emulsion, since it exerts a tearing action against the natural tendency of the asphalt to coalesce.

The bentonite-water gel is heated and the hot asphalt poured into it in a thin stream, with continuous stirring. After thorough mixing, the thick product can be further diluted with water, depending on its ultimate use. The final proportions of a fairly thick emulsion could be 10 parts bentonite, 90 parts water and 250 parts asphalt. For asphalt paint, 150 parts water with the above quantities of bentonite and asphalt would be effective.

When the compound has been formed, the bentonite surrounds the asphalt globules, forming a protective sheath against coalescence. The mixture remains plastic when kept in a container, and need not be heated to be applied to a surface. While in the plastic or mobile condition the volume of the hydrated bentonite, due to its swelling properties, is about seven times that of its dry volume. When the material is spread upon a surface the water evaporates, and the bentonite shrinks back to its original dry volume, forming cells of microscopic size between the particles of asphalt. These cells, now dry, are porous and become permeated by the asphalt, which gradually reaches complete coalescence. The film or body is then impervious to water.

The pH value of the final product is an important factor influencing stability. A slightly acid reaction is conducive to maintaining good adherence between the bentonite particles and the asphalt. Bentonite itself gives a slightly alkaline reaction in solutions and aluminum sulphate or small quan-

[2] Miscall, Chem. & Met. Eng. 37 (1930); Kirchbraun, U. S. 1,918,759 (1933).

tities of acids are sometimes added to the water to lower the pH. e.g., 0.007% citric acid.

To improve suspendability, small amounts of other colloids may be helpful. Gum karaya, gelatin, starch, dextrin may be used for this purpose. One patented process mentions the use of a citric or tartaric acid to improve mobility, allowing for fluid emulsions containing less water and more asphalt. Another mentions that soap-asphalt and bentonite-asphalt emulsions be made separately and then mixed. It is said that bentonite emulsions may be more successfully made with high melting point bitumens, than with the low melting ones; whereas soaps act oppositely in this respect.

There are many patents describing and covering processes and refinements. A partial list follows:

U.S.

1,302,810	1,663,652	1,734,437	1,788,706	1,918,759
1,479,042-43	1,679,475	1,738,509	1,802,561	1,948,881
1,498,387	1,690,020	1,738,776	1,829,722	1,957,408
1,517,075	1,691,765-6-7-8	1,738,906	1,865,634	1,959,586
1,615,303	1,722,431-2-3-4	1,781,654	1,882,834	1,960,112
1,620,899-900	1,725,645-6-7-8	1,782,536	1,889,437	1,963,231
1,663,095	1,733,493-4-5-6-7-8	1,787,418	1,916,885	

Whereas some Venezuelan and Mexican asphalts are directly emulsifiable in aqueous alkali (presumably because they contain traces of naphthenic acids),[2a] most asphalts require a soap or another dispersing agent for satisfactory emulsification.

When the melted bitumen is emulsified by stirring into it a hot concentrated aqueous soap solution, the latter is considered desirable.

A highly important factor in production is the use of soft water. Hard waters must be softened, e.g., by the "Permutit" or other process, before use. Viscosity is a particu-

[1] Preaubert, Brit. 9,422 (1905).

larly important property of asphalt emulsions for two reasons.[2] First, it governs the workability of the emulsion, which must be applicable to paving aggregate or other surfaces. For this purpose the viscosity must be low. Secondly, viscosity influences adhesion and it must be high enough so that the emulsion clings until phase separation results.

Bituminous emulsions made with soluble emulsifying agents, such as soap, are rendered fluid by the addition of substances, such as calcium chloride, which form insoluble compounds with the emulsifying agent. The drying or settling characteristics of such fluid emulsions are increased by the addition of stabilizers, such as sodium phosphate, which do not increase their viscosity.[2b]

Road emulsions contain 56–60% asphaltic bitumen, but emulsions can be successfully made with over 80% bitumen. The higher surface tension and specific gravity of tar make it more difficult to emulsify, but these disadvantages are overcome by the emulsifying tendencies of some of its constituents.

The degree of dispersion of a bituminous emulsion varies with the pH of the aqueous phase, and the maximum dispersion corresponds to a maximum stability; the stability is greatly affected by different emulsifiers, e.g., the stability of a Panuco bitumen without an emulsifier or softener lies within the pH limits of 10.2 to 12.5. When emulsified with 0.9% of olein the stability limit is found within a pH range of 8.1 and 12.6. Viscosity and breaking point are also affected by the pH. Control of viscosity by pH has some practical difficulties and it is wise to employ such materials as stearic acid or sulfonic acids.[3]

In actual use, the emulsifier must be present in as small a

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[2] P.C.

[2b] B. I. Inc., Fr. 760,544 (1934).

[3] Yellinger, 11e Congr. Mond. Petrole *2*, 659 (1930).

proportion as possible, partially to avoid re-emulsification under traffic, and partially to avoid diminishing the adhesive power of the bitumen to the mineral matter of the road surface. As a rule, the more finely divided the binding material, the lower is the amount of emulsifier required. Generally, dissolved salts, both in the manufacture and in breaking on the road, effect the electric charges of the suspended particles to a degree sufficient to reverse or even destroy the colloid system.[4]

Another important property is emulsion stability, since the emulsion must not break until after application. A sensitive emulsion will break if the mixer runs too fast, or sometimes merely from gravity flow if the mixer is much higher than the receiving tank. On the other hand, asphalt emulsions may be made so stable that they can be centrifuged without breaking. Tall oil is an effective stabilizer, containing both resin acids and fatty acids. As a rule an asphalt which is difficult to emulsify gives sensitive emulsions,[5] requiring more stabilization than would a readily emulsifiable asphalt.

The most common bituminous emulsions used in road building are made with asphaltic bitumen, a residual petroleum refining pitch. Since their viscosity directly affects spraying and coverage, this property is quite important.[1] Uniformity and globule size of bitumen emulsions are governed by the grade of bitumen used. Since there is a definite variation in every batch of bitumen, it is necessary to regulate the manufacturing procedure in order to maintain fairly uniform production.[2]

While colloid mills are preferred, other mixers may be used in most cases. To get optimal results, experimental runs

[4] Spielmann, Munic. Eng. Sanit. Record *84,* 624 (1929).
[5] Nussel, Bitumen *11,* 45 (1941).
[1] Jap. J. Eng. Abstracts *17,* 7 (1939).
[2] Khim. Ref. Zhur. *11,* 119 (1939).

must be made to determine the best operating conditions.

Bitumen contains acidic materials which saponify with alkalies to form emulsifiers. Where the acidic content is too low, fatty acid or soap is added. Some free alkali is always needed to get the best dispersion.[3,4]

The best procedure is to add the melted bitumen slowly to the aqueous alkali solution which is heated to a boil in the mixer. Emulsification is complete in 2–3 minutes. At this time some soap or other stabilizer is added if the emulsion is not used at once.[5]

In another method bitumen is melted with fatty acid in the mixer, and then a boiling concentrated aqueous alkali solution is added. This is then diluted with hot water.[6] The significance of various emulsifiers for bitumens is discussed by Rick.[7]

Silica, iron oxide and gypsum promote the formation of asphalt in water emulsions. Limestone, magnesium carbonate, calcium hydroxide, magnesium hydroxide and Portland cement promote water in asphalt emulsions.[8]

Becker [9] gives detailed directions for the laboratory preparation, commercial manufacture and testing of bituminous emulsions. A description of laboratory and technical equipment is also given with the aid of numerous photographs, photomicrographs, diagrams and tables. These tables summarize the results of laboratory tests of the preparation and properties of various emulsified asphalts containing such emulsifiers as tall oil, chlorinated tall oil, montan wax, naphthenic acid, olein and stearin pitch. The optimal proportions

[3] Kozi Doi. Jap. 129,057 (1939).
[4] Technical Aspects of Emulsions, p. 136.
[5] Montgomerie, Brit. 226,032.
[6] MacKay, Brit. 202,021.
[7] Rick, Teer v. Bitumen *32,* 113 (1934).
[8] Ebberts, Rock Products *33,* 53 (1930).
[9] Becker, Bitumen *11,* 38 (1941).

and properties of asphalt, water and emulsifier have to be determined for each technical use by systematic series of tests.

Bitumen emulsions are classified [10] as to stability by Neubronner.

The use of asphalt emulsions for road building and water proofing of paper, concrete, and similar purposes from 1907–1928 is exhaustively reviewed by Leemans.[11]

Cosmetic Emulsions

Emulsions figure predominantly in cosmetic preparations. The following are typical examples: cold cream, vanishing cream, shaving cream, hand lotion, bath-milk, etc. The first is usually of the W/O type, while the others are O/W.

The various aliphatic alcohol bases suitable for use in cosmetics and toilet preparations, comprise cetyl, cetyl-stearyl alcohol mixtures, technical stearyl, myristyl and oleyl alcohols and various proprietary agents based on admixtures of these with a small percentage of aliphatic alcohol sulfonates, such as sodium lauryl sulfate. Sulfonated aliphatic alcohols are produced by the reaction of sulfuric acid with alcohols of high molecular weight to give alcohol sulfates. Since sulfuric acid is dibasic, one acid hydrogen remains after esterification, this being replaced, for example, by sodium to yield the sodium salt. In the manufacture of cosmetics and toilet preparations, aliphatic alcohol sulfates are employed as emulsifying agents, soap substitutes and foaming agents. The most commonly used emulsifying agents consist of mixed aliphatic alcohols (about 90%) and aliphatic alcohol sulfates. Recently, phosphates, as well as sulfates, have been used. Such emulsifying agents are readily

[10] Neubronner, Teer v. Bitumen *32,* 211 (1934).
[11] Leemans, Chem. Weekblad *26,* 2 (1929).

self-emulsifiable in water, and give creams of the oil-in-water type, such as skin foods, nourishing cream, night creams. On the other hand, they can also form oil-in-water emulsions with a variety of oils, fats, and waxes.[1]

Some of the more recently introduced emulsifying agents, used in the cosmetic industry are:

"Acimul"	Mannitol Oleate
Aminoalcohols	Monoethanolamine
Ammonium stearate, anhydrous	Monostearin
"Deramin"	Sorbitol Laurate
Diglycol Laurate	Triethanolamine
"Emulgor" A	"Trigamine"
Glyceryl Monostearate	"Trigamine" Stearate
"Glycosterin"	"Trikalin"

Errors in Making Creams[2]

When using white oils, paraffin, petroleum jelly, stearic acids, etc., in the manufacture of creams, it must always be remembered that the qualities offered vary considerably. There are heavy and light mineral oils, paraffins of varying melting points, and petroleum jellies of varying viscosity. The quantity of water, for instance, which is to be added to hair creams, depends largely on the viscosity of the mineral oil used. It is preferable to use a heavy oil and more water rather than a thin oil and less water. Furthermore, the creams made with heavy oils are usually better and considered preferable by the buyer to those made of thin light mineral oils.

In making face creams the mistake is often made of not working at the correct temperatures. While a cream containing lanolin or similar absorption bases is made at slightly above room temperature, it is necessary in certain instances

[1] Jannaway, Perf. Essent. Oil Record *30,* 45 (1939).
[2] Schimmel, Amer. Perf. *32* (Oct. 1941).

to increase the temperature of production. For instance, a higher temperature is required when it is a case of a mixture of paraffin with an emulsion containing soap, or if another emulsifying agent is concerned which is not particularly sensitive to heat and is used together with ceresin or ozocerite. Otherwise it is possible that the distribution of the added wax or paraffin is not sufficiently thorough.

If creams deteriorate occasionally, the reason for this may be that the materials used are not mutually compatible. For instance, the use of lemon juice in an alkaline cream is rather dangerous and often unsuccessful. Another reason for deterioration may be that distribution in the inner phase of the emulsion is at fault.

Another matter for consideration is that the presence of the electrolytes such as salts of magnesium, zinc, or bismuth, deficient viscosity, and the use of unsuitable emulsifying agents can considerably affect the quality of the cream. Occasionally insufficient emulsification may be corrected by passing the cream through a colloid mill or homogenizer. In certain instances the stability of the emulsion will thereby be increased and also the quality of the cream be improved. In some cases the stability of the cream may also be bettered by the addition of small quantities of wax and stearic acids. Certain emulsions such as creams containing gums and tragacanth are preferably made without the use of a homogenizer, as the emulsifying properties of the gum or tragacanth may be destroyed. The increased temperature and pressure caused by the passage through the homogenizer may furthermore have a detrimental effect on the already existing emulsion which may be sensitive to heat.

Another mistake which occasionally occurs in cream manufacturing is the simultaneous preparation and use of different types of emulsions. For instance the error may be made of adding comparatively large percentages of lanolin to a beauty

milk, based on triethanolamine stearate. Through the addition and the ensuing slow increase of water content, a water-in-oil emulsion will first be formed, which will then be changed into an oil-in-water emulsion with the result that the emulsion is unstable.

Miscible, "Soluble" or Cutting Oils

A miscible oil is a clear solution of an emulsifier in an oil which emulsifies on mixing with water. A cutting oil is a "soluble" oil having lubricating, cooling, and non-corrosive properties.

In making miscible oils a coupling agent or mutual solvent is included to give a clear, uniform solution.

Free oleic acid is necessary to make clear water-miscible "soluble" oils, however it has a tendency to break emulsions made with a "soluble" oil and its relative proportion is often highly critical. The kind and quality of the mineral oil used has very little effect on the quantity of oleic acid used. Alcohol is usually added. It first acts as a liquefier and in large amounts, causes an increase in the quantity of oleic acid required. It exerts no direct effect on the emulsion.

The addition of alkali to a "soluble" oil, containing acid sulfonated oil, in the absence of alcohol, first decreases then increases the amount of oleic acid needed; in the presence of sufficient alcohol, the more alkali present the less oleic needed. The more neutralized the sulfonated oil, the better [1] emulsifier it is.

When soaps are used phenols are often employed as introfiers [2, 3] as are amyl alcohol,[4] ethyl alcohol,[5] glycols [6] and

[1] Hart, J. Ind. & Eng. Chem. *21,* 85 (1929).
[2] Woodman, J. Agric. Soc. *17,* 44 (1927).
[3] Woodman, J. Pom. Hort. Sci. *5,* 43 (1925).
[4] Woodman, J. S. C. I. *49,* 93T (1930).
[5] Melander, Wash. Agric. Exp. Sta. Bull. *197,* (1926).
[6] P.C.

glycol ethers.[7] Triethanolamine soaps and fatty acid esters of polyhydric alcohols containing at least one free hydroxyl group (e.g., glycol monolaurate) are also used. Many liquids which are soluble in both phases can act as introfiers and add stability. In many cases the addition of water is also necessary,[8] thus a miscible oil is a three or four component system.[9] The quantity balance of each compound is a critical factor in producing miscible oils.[10, 11]

The pH of "soluble" oils usually is between 7 and 9. This is due to hydrolysis of the emulsifier. If, however, the water used contains appreciable amounts of salts of strong acids and weak bases, the emulsion will have a lower pH.[12]

Cutting fluids are used both to cool and to lubricate. When lubrication is important it is generally recognized that fatty oils are superior to mineral oils. The evidence apparently proves that the fixed oils owe their superiority not to differences in viscosity or surface tension, but to residual valence or acidity which causes them to adhere more firmly to the metal than do the mineral oils. Mineral oils may have substances added to them which will, for some purposes, make them superior to lard oil. For many purposes, the addition of fatty acids, pine oil or sulfur derivatives to mineral oils will make it possible to obviate the use of expensive fixed oils.[13]

Detergent Emulsions

A detergent acts by suspending foreign matter in a liquid or foam. It floats off the "dirt." This, of course, presup-

[7] P.C.
[8] P.C.
[9] Technical Aspects of Emulsions p. 85 (1936).
[10] Woodman, J. S. C. I. *52*, 185T (1933).
[11] Lehnes, Farber Z 156 (1904).
[12] Billings, Amer. Dyestuff. Rept. p. *26* (May 16, 1938).
[13] Bingham, U. S. Bureau of Stand. Tech. Paper *16* No. 204, 35 (1922).

poses a lowered surface tension. Where the dirt is enclosed or imbedded in oil, fat, and the like, an emulsifying action is necessary. Added alkalies, within certain limits are often helpful,[5] as is the addition of solvents.

Difficulty in removing mineral oil from wool with soap and soda, is attributed to the great adhesive power between the oil and wool resulting from the great oil-water interface tension. This tension may be reduced by the addition of long chain aliphatic alcohols (e.g., oleyl alcohol) or cetyl alcohol sulfate.[1] The use of 6% oleyl alcohol seems to be optimal. Greater amounts hinder oil removal.[2] Ease of removal of mineral oil from wool is dependent in the first place on the distribution of oil-soluble polar compounds between wool-oil and oil-water interfaces, secondly on the degree of oil-water interfacial tension and, thirdly on adhesion.[3] The optimum pH for scouring is 9.5–10.7.

Emulsification in hard water is accomplished with salts of both sulfated higher fatty alcohols and substituted aromatic sulfonated acids, soap, and sodium hexametaphosphate (Calgon).[4]

Food Emulsions

Both natural and man made emulsions serve as foods in numerous instances. Natural emulsions are typified by cream and milk. Man made edible emulsions are exemplified by mayonnaise, salad dressing and shortening.

If the proportion of oil to egg or to emulsion already produced is kept below a certain maximum, a stable emulsion

[5] Hannay, J. Soc. Dyers & Color. *50*, 273 (1934).
[1] Speckman, Trans. Far. Soc. *29*, 358 (1933).
[2] Tech. Aspects of Emulsions p. 104 (1936).
[3] Ibid., p. 106.
[4] Ibid., p. 107.

always results regardless of temperature or manner of beating. If the proportion of oil exceeds a certain minimal proportion, the egg or emulsion already produced always becomes dispersed in the oil and no permanent emulsion is formed. If proportions between the limits are used the formation of a permanent emulsion depends upon such variables as temperatures and method of beating. If the egg is previously diluted with vinegar the proportion of oil which can be emulsified is greatly increased during the first and second additions of oil, but with increase in viscosity the maximum ratio of oil to emulsion rapidly approaches the value obtained when egg is used alone.[6]

Mayonnaise is a typical edible emulsion. It consists of a dispersed phase (vegetable oil), a continuous phase (water), emulsifying agents (egg yolk and mustard and vinegar) and/or other flavoring materials. Egg yolk is the most efficient edible emulsifying agent for O/W emulsions. Its phosphatide content (chiefly lecithin) tends to produce O/W emulsions, whereas its cholesterol tends to the opposite type.[2, 3] Any change in proportions of lecithin and cholesterol will affect the stability or type of emulsion.[4] This is probably why fresh egg yolk is more efficient than the frozen product in which the lecithin is partially hydrolyzed. (Lecithin always undergoes hydrolytic changes on aging and thus will vary in its action. Cholesterol is relatively stable.) [1]

In mayonnaise manufacture, a pre-mix of all the oil, emulsified in a small part of the aqueous phase, is added to the rest of the aqueous phase. The great ratio of oil to water tends to make the W/O type, but the emulsifying agent pre-

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[6] Mark, J. Home Econ. *13*, 447 (1921).
[2] Seifriz, Amer. J. Physiol. *56*, 124 (1923).
[3] Bhatnagar, J. Chem. Soc. *119*, 1760 (1921).
[4] Corran, Biochem. J. *18*, 1368 (1924).
[1] Technical Aspects of Emulsions, p. 91.

vents this. The reason for this method is that it produces a high viscosity which permits better mixing and the use of a smaller amount of emulsifier. Mayonnaise and certain other types of oil-rich emulsions are not homogenized because such treatment may break the emulsion.

Powdered mustard is used in mayonnaise to prevent formation of lime soaps, when hard water is used, with resultant W/O type formation.[5]

Careful adjustment of viscosity in W/O emulsions and use of proper emulsifiers (Palsgaard Emulsion Oil) ensures stability up to 100° C with resultant saving in the amount of fat used.[7]

Breaking of mayonnaise and dressing may be due to: (1) wrong proportions of oil, water and egg (best proportions are 78, 17, 5); (2) too rapid addition of oil; (3) wrong type of agitation; (4) effect of heat; (5) freezing; (6) alum (as in pickle relishes); (7) salt causes thickening; (8) starch (added) is hydrolized by acid; (9) bacterial decomposition; (10) evaporation of water; (11) vibration.[8, 9]

Shortening is a W/O emulsion of edible oil or fat used in baking. Many emulsifiers have been used, e.g., polymerized or oxidized glycerides of unsaturated fatty acids.[10]

The necessity for having a hydrophilic group and a lipophilic group, in an effective margarine emulsifier, indicates the desirability of polyglycerol as a component. Exhaustive esterification of the polyglycerol with a suitable fatty acid is the next step in making an active emulsifier. A phosphatide group, esterified once with hydroxyethyltrimethylammonium hydroxide, provides a potent hydrophilic group. A good emulsifier for margarine must be miscible with water and

[5] Food manufacture, *1*, 17 (1934).
[7] Petersen, Fette u Seifen *46*, 458 (1939).
[8] Gray, Oil Fat Ind. *4*, 410 (1927).
[9] Technical Aspects of Emulsions p. 96.
[10] Schou, U. S. 2,220,976 (1940).

should be effective at 0.5% concentration in fat-water mixtures.[11]

Latex Emulsions

Rubber latex, coming from various species of plant, possesses different properties. Most of them are dispersions rather than emulsions.[1a] The percentage of rubber, in natural latex, usually is 35–40. A natural protein is present as a stabilizer.

Latex is concentrated by creaming, warming and removing the cream layer mechanically; also by Irish moss,[1, 2, 3] other colloids,[4] gum tragacanth,[5] pectin,[6] gelatin,[7] ammonium alginate,[8] agar, and casein.[9] Creaming is hastened by centrifuging,[10] low electrical potentials,[11] evaporation after addition of soap,[12] addition of alcohol.[13] Saponin, peculiarly, acts as a stabilizing agent.[14]

Dry powders used in concentrating latex must first be wetted by an aqueous solution of the stabilizer.[3a]

Concentrated latex, having a larger percentage of protective colloid, is usually more stable than normal latex.

[11] Palladina, Maslo. Zhirov. Delo *2,* 30 (1939).
[1a] Technical Aspects of Emulsions p. 121.
[1] Biochem. Z. *149,* 525 (1924).
[2] Brit. 226,440 (1924); U. S. 1,754,842 (1930).
[3] K.D.P., Brit. 237,269 (1929); Fr. 686,821 (1929); Westcott, U. S. 1,754,535 (1930).
[4] Rossman, India Rubber World *87* (vi) 33, (1933); Ibid., *88* (iii) 31, (1933).
[5] Johnson, Brit. 286,527 (1927).
[6] McGavack, U. S. 1,647,805 (1927); Pektinges, Ger. 560,259 (1923).
[7] Banks, U. S. 1,755,279 (1920).
[8] General Rubber, Brit. 294,002 (1927).
[9] Loomis, U. S. 1,816,018 (1932).
[10] Westcott, U. S. 1,754,535 (1930).
[11] McGarack, Brit. 344,647 (1929); Ibid., U. S. 1,921,575 (1933).
[12] Technical Aspects of Emulsions p. 126.
[13] Stevens, Brit. 415,133 (1933).
[14] Teague, U. S. 1,772,647 (1930); Nikitin, U. S. 1,880,975 (1932).
[3a] Ibid., p. 128.

Hevea latex becomes acid on standing and coagulates. Ammonia is usually added to prevent this. Such preserved latex may be coagulated with salts (aluminum sulfate) while still alkaline.[2a] Sodium silicofluoride, hydrophilic materials (e.g., alcohol, acetone, carbon-black, cement) will achieve the same effect. These materials probably act by absorbing some of the water.

The viscosity of aqueous rubber dispersions first increases linearly with dispersion of the water in the rubber, and then decreases with formation of a dispersion of rubber in water. With increasing plasticity of the rubber, the quantities of alkali needed as dispersing agent decrease, and the sizes of the dispersed particles are smaller, and lie within narrower limits. The viscosity of the dispersion for a given concentration varies with alkali concentration.[15]

Leather Emulsions

In the manufacture of leather dilute O/W emulsions, called fat liquors, are used extensively. The oils are triglycerides or mineral oils and the emulsifiers are soap or sulfonated oils.

The following emulsions are used in the manufacture of leather:

Oil with glue or gum, gum and starch,[1] sodium glycerophosphate,[2] neats-foot oil with aluminum hydroxide;[3] oil with esters of sulfo-fatty acids and albumin or glue;[4] oil with tertiary or quaternary amine salts;[5] oil with methyl cellu-

[2a] Ibid., p. 125.
[15] Dogadkin, Colloid J. (U.S.S.R.) *1,* 447 (1935).
[1] Rohm, Brit. 353,846 (1929).
[2] Rohm, U. S. 1,981,363 (1932).
[3] Rohm, U. S. 1,751,217 (1930).
[4] Bohme, A. G. Brit. 313,966 (1928).
[5] Somerville, U. S. 1,883,042 (1932).

lose;[6] oil with lecithin;[7] oil with residue from extracted soy-bean phosphatides;[8] and oil with bentonite.[9]

Medicinal Emulsions

Toxic doses of diphtheria and tetanus toxin may be safely injected subcutaneously if they are emulsified in a finely dispersed oil in water emulsion (5% olive oil in 0.2% solution of sodium oleate and brought to pH 8 with sodium carbonate).[1]

Improved methods for making pharmaceutical emulsions of turpentine, paraffin oil and other oils are given by Hall.[2]

The most commonly used medicinal emulsions are those of highly refined viscous mineral oil and cod-liver oil.

Paint Emulsions

Most emulsion paints are O/W carrying pigment, wetted by water. The stabilizer is usually a protein (casein or glue) and the oil phase (varnish) is of high viscosity. The emulsifier may be soap or a sulfated product. The warm oil is usually added to the water containing the protein and soap. Emulsification proceeds smoothly on mixing and the water wetted pigment is dispersed in the aqueous phase. The emulsion may be slowly diluted with water before use.[1]

Breaking of paint emulsions often is due to shaking in transportation or too vigorous mixing before application with the brush. This is due to penetration of pigment particles into the protective oil layer and their being wetted by

[6] I.G., Ger. 524,211 (1926).
[7] Bollman, Ger. 414,399 (1927).
[8] Muhlenwerke, Ger. 522,041 (1927).
[9] Progil, Fr. 742,563 (1933).
[1] Walsh & Frazer, Brit. Med. J. March 10, 1934.
[2] Hall, Pharm. J. *135*, 133 (1935).
[1] Khim, Referat. Zhur. *8*, 103 (1939).

the oil phase. Aging of the emulsion before pigmentation often improves stability.

Certain emulsion paints are as of good quality as non-emulsion paints; they are more economical; and have equal covering power. The W/O type is superior; the inclusion of oxidized instead of raw oils is preferable; and less than 25% water should be used. These emulsion paints can be used indoors or outdoors when properly made, but they are not recommended for unprimed iron.[2]

The amount of emulsifier determines the type of paint emulsion. Using ethanolamine or triethanolamine soap 0.25–6% gives W/O while 10% gives O/W.

Emulsions containing glue [3] may give rise to the following film types: (1) hydrophilic films with a glue-cellular structure, (2) two-layer films with a continuous oil surface and an undersurface interspersed with glue cell walls, and (3) films of true varnish type. Emulsions yielding type-1 films should be based on casein rather than on animal glue, which is the more easily reversed. Excess of alkali may be incorporated into emulsions containing saponifiable oils on account of the emulsifying action of the soaps produced. Emulsifiers such as sulfonated fatty alcohols or triethanolammonium esters should be added to the media containing unsaponifiable matter, and hydrophilic wetting agents to pigmented emulsions.

Polish Emulsions

Emulsion shoe polishes consist of mixtures of waxes, with or without solvents, emulsified with alkalies. Potassium carbonate is preferred as an alkali because it gives more uniform dispersions. It is necessary to use only a small amount of alkali to saponify part of the fatty acid contained in the wax. This then acts as an emulsifier for the rest of

[2] Ibid., *11,* 109 (1939).
[3] Wagner, Chem. Z. *60,* 393 (1936).

the wax. Soap is often added as an auxiliary emulsifier because of its bodying and lubricating effect, and especially when using waxes containing little or no free fatty acid.

A typical procedure is to dissolve the soap, alkali, water and soluble dye in boiling water in the foregoing order and then add the melted waxes, resins and solvents slowly with good mixing. Heating is continued until all the carbon dioxide gas has been eliminated and until the emulsion is homogeneous. Containers are best filled at the lowest possible temperature (just above the setting point) and containers should be allowed to cool uniformly and not be disturbed until their contents have solidified.

Sodium carbonate gives harder products that will hold larger percentages of water. Potassium carbonate is preferred because the finished product, made with it, has a lesser tendency to shrink and contract. Borax, ammonia and organic amines are also used as alkalies to obtain special polishes.

Floor, furniture and automobile polishes are essentially very similar to shoe polishes except that they are more fluid. While formulation is different, their method of manufacture is the same.

Transparent Emulsions

Transparent emulsions are made by equalizing the refractive indices of the phases [1] and stabilizing the emulsion by equalizing the phase densities.[2] Carbon tetrachloride and glycerol are suitable liquids for raising refractive indices.[3] Concentrated invert sugar and sucrose solutions may also be used for this purpose. These transparent emulsions can be made very stable by proper formulation and technique.

[1] Rector, U. S. 1,389,161 (1921); Whatmough, U. S. 1,663,323 (1928).

[2] Volek, U. S. 1,914,902 (1933); Imray, Brit. 200,036 (1923); Hartman, U. S. 1,611,190 (1826).

[3] Holmes, Introductory Colloid Chemistry p. 82, (1934).

Coconut oil ethyl ester is suitable for lowering refractive indices of oil.

Glycerin and tartaric acid are used for increasing refractive indices of sugar solutions.

Gelatin is the most efficient of the peptizing agents examined, while gum arabic ranks second. Examples of these are the transparent emulsions of orange, peppermint, lemon, lime and rose oils made with gelatin, gum arabic, gum tragacanth or agar-agar as emulsifier.

Agar-agar and tragacanth have sometimes proved unsatisfactory peptizing agents.[4] The problem of graining may be solved by employing a mixture of two parts invert sugar and one part sucrose, instead of straight invert sugar in the dispersion medium. The colloid mill is indispensable in the preparation of this type of dispersion.

Emulsions of varying colors are made with nitrocellulose (dry) glycerol, and carbon bisulfide added in a definite way, in different proportions.

These colors are also changed by heat.[5] To make similar chromatic emulsions, the continuous phase must have two mutually soluble liquids, one having a high refractive index and high optical dispersive power. Benzol, rubber and water also produce chromatic emulsions.

Wax Emulsions

Stable wax emulsions, usually have a uniform particle size of about 10^{-4} cm.

Most troubles in making wax emulsions are caused by specks or clumps of incompletely melted or chilled wax. It is therefore, essential that a sufficiently high temperature of both phases be maintained to avoid such difficulties.[6]

[4] Whitmore, J. Ind. & Eng. Chem. *21,* 878 (1922).
[5] Holmes, J. Amer. Chem. Soc. *21,* 878, (1929).
[6] Billings, Amer. Dyestuff Rept. May 16, (1938).

CHAPTER VI

DISPERSING AGENTS AND WETTING AGENTS

Dispersing Agents

A DISPERSING agent is a compound which separates aggregations of particles of matter by neutralizing the cohesive attraction between them. A dispersing agent may have but little effect on the surface tension. Consequently, its wetting properties may be negligible. Its action is very specific—working well in some systems and not in others. A dispersing agent may be either inorganic or organic. An interfacial tension against mineral oils below 11 dynes per c.c. usually indicates a good dispersing agent.

A dispersing agent shows the greatest effect with highly flocculated hydrophobic systems.[1] In very adhesive products, e.g., coagulated latex, mechanical force is often necessary before the dispersing agent can exert its action.

Protective colloids should not be used with dispersing agents as they interfere with each other, because of their adsorptive properties. This caution also applies to using wetting agents with dispersing agents.

The following are a few materials that are being used commercially as dispersing agents:

[1] Daniel, Rubber Age *48*, (Dec. 1, 1939).

Darvan;[1a] Daxad[2]
"Glaurin"[3]
Glycol Naphthenate[3]
"Hornkem"[4]
Sodium Lignin Sulfonate[5]

Wetting Agents

Wetting agents are generally materials which, in small amount, greatly reduce the surface tension of water and lower the interfacial tension between water and another contacting surface. A good wetting agent shows a surface tension of 30 dynes per c.c. or less in solution. Interfacial tension is the surface tension at the interface (region of contact) between two immiscible phases. This region may be liquid and air, liquid and a solid, or two liquids.

There seems to be considerable confusion as regards the terms "wetting" and "dispersing." As stated previously, a wetting agent is a material which will reduce the surface tension of water and lower the interfacial tension between the water and another surface, so as to form a solid-liquid, or liquid-liquid interface. On the other hand, a true dispersing agent usually has little effect on the surface tension of water. An aqueous dispersing agent is a material which promotes the separation or deflocculation of particles, which is accomplished by overcoming the adhesive forces between the individual particles.[1]

Wetting agents usually contain, both polar and non-polar groups. The following table[11] gives their characteristics.

[1a] R. T. Vanderbilt Co., New York, N. Y.
[2] Dewey & Almy Chem. Co., Cambridge, Mass.
[3] Glyco Products Co., Inc., Brooklyn, N. Y.
[4] A. C. Horn Co., Long Island City, N. Y.
[5] Marathon Chemical Co., Rothschild, Wisc.
[1] Wetting Agents, Their Structure, Etc.; Paper Trade Journal, August 1940.
[11] Christmann, Amer. Cyanamide Co. Tech. Paper 17 (1930).

The polar group has an affinity for water and water-soluble materials and the non-polar group prefers oily and water-insoluble materials. The balance of these two groups and their positions in the molecule determine the compound's characteristics.

POLAR-NONPOLAR COMPOUNDS

Polar (Salt)	Nonpolar (Mineral Oil)
Ionized	Nonionized
High Dielectric Constant	Low Dielectric Constant
High Melting Point	Low Melting Point
Soluble in Water	Insoluble in Water
Insoluble in Organic Solvents	Soluble in Organic Solvents
High Boiling Point	Low Boiling Point
Melt Conducts Electricity	Melt does not Conduct Electricity

Many varieties of wetting agents are available and used for different purposes under different conditions. The most commonly used method of evaluation is that of Draves-Clarkson.[12] It consists of measuring the time necessary for a 5-gram skein of unboiled two-ply cotton yarn to sink in a definite concentration of a wetting agent in water at a definite temperature.

Anion surface active compounds are characterized by having a negative charge on the surface active or non-polar group. On electrolysis of a solution of such a compound the latter group goes to the anode.

Cation active compounds are those whose cation is the effective agent. On electrolysis of a solution of such a compound, the active non-polar group travels to the cathode. Compounds in this class are the quaternary ammonium salts, sulfonium and phosphonium compounds.

Mixing anion and cation active compounds is detrimental

[12] Draves, Amer. Dyestuff Rept. *28*, 425 (1939).

as they tend to form a precipitate by neutralizing their charges.[13]

Non-ion active compounds are those emulsifiers possessing inactive anions and cations, e.g., nonaethylene glycol laurate or "Emulgor A."[14]

As the length of the polar chains is reduced, the solubility is increased. It is noted that the sodium salt of dioctyl ester of sulfosuccinic acid is soluble to the extent of approximately 1.5% and that as the length of the polar chain is reduced still further, the solubility is further, though not markedly, increased. However, in doing so, the wetting power is adversely affected in ordinary water. For example, the sodium salt of the dibutyl ester of the sulphonated dicarboxylic acid has no wetting power in ordinary water at a concentration of 1%.[15]

Wetting intensity and protective colloid properties are unrelated for many wetting agents.

Wetting agents are specific. One agent may work well in the presence of a hydrophobic material and not with a hydrophilic material. Therefore, stating that a substance is a good wetting agent is incomplete unless the exact nature of the surface or interface is indicated.[16]

Some of the more commonly used wetting agents are the soluble salts of sulfated higher fatty alcohols, sulfonated amides, fatty acid ester sulfonates, sulfonated ethers, alkyl aryl sulfonates and polyhydroxy alcohols partially esterfied with higher fatty acids. A partial list of surface active agents follows:

[13] Dhingra, J. Soc. Dyers Colourists *53,* 91 (1937).
[14] Glyco Products Co., Inc., Brooklyn, N. Y.
[15] Wetting Agents, Their Structure, etc. Paper Trade Journal, Aug. 22, 1940.
[16] Bartell, J. Ind. Eng. Chem. *31,* 31 (1939).

COMMERCIAL SURFACE-ACTIVE AGENTS

Product	*Composition*
Aerosol AY	Diamyl ester of sodium sulfosuccinic acid
Aerosol 1B	Dibutyl ester of sodium sulfosuccinic acid
Aerosol MA	Dihexyl ester of sodium sulfosuccinic acid
Aerosol OS	Alkyl aryl sulfonate
Aerosol OT	Dioctyl ester of sodium sulfosuccinic acid
Ahco Penetrant L	Alkyl aryl sulfonate
Alframine DCA	Sulfated glycerylamide
Aliphatic ester sulfate	Oil ester sulfate
Alkamine W	
Alkanol B, SA, HG.	Sodium alkyl naphthalene sulfonate
Alkanol S	Sodium tetrahydronaphthalene sulfonate
Amalgol	
2-Amino-1-butanol	Fatty acid soaps
2-Amino-2-ethyl-1,3-propanediol	Fatty acid soaps
2-Amino-2-methyl-3-hexanol	Fatty acid soaps
2-Amino-2-methyl-1,3-propanediol	Fatty acid soaps
2-Amino-2-methyl-1-propanol	Fatty acid soaps
Anthrapole	Sulfonated oil + solvents
Appretole	Glyceryl sulforicinoleate
Arctic Syntex A	Oleic acid ester of sulfonated aliphatic compound
Arctic Syntex M	Sulfate of mixed fatty acid monoglycerides
Arctic Syntex T	$C_{17}H_{33}CONH\text{-}C_2H_4\text{-}SO_3Na$
Areskap	Monobutyl phenyl phenol sodium monosulfonate
Aresket	Monobutyl diphenyl sodium monosulfonate
Aresklene	Dibutyl phenyl phenol sodium disulfonate

Product	*Composition*
Aromine PM	Organic sulfonate + solvents
Arylene	Sulfonated aromatic
Avitex AD	Fatty alcohol sulfate
Bensapol	Sulfonated oils & solvents
Betasol OT-A	Sulfonated ester of dicarboxylic acid
Bozetol	Sulfonated castor oil derivative
Burkol	Organic sulfonate
C.A.C. 2720	Phosphorated amine
Calgon	Sodium hexametaphosphate
Cominol	Derivative of higher sulfonated alcohol
Cresol	$C_6H_5OH\text{-}CH_3$
Cyclohexanol	Hydrogenated phenol
Daconol	Alkyl aryl sodium sulfonate
Darvan	Polymerized organic salts of alkyl aryl sulfonic acids
Daxad	Same
Deceresol OT	Dioctyl ester of sodium sulfosuccinic acid
Detanol	Derivative of higher sulfonated alcohol
Diethylenetriamine Soaps	
Diglycol Laurate	
Dilex	Purified sulfo-lignin
Dipex	Water-soluble sulfonated mineral oil
Dreft	Fatty alcohol sulfate
Drene	Same
Duponol D, LS	Fatty alcohol sulfates
Duponol 80, WA, ME Dry PC Special WA	Same
Duponol G, OS, WS	Same
Elemite	Sulfonated oils & solvents
"Emulgor A"	Polymerized ethylene glycol ester
Gardinol LS, WA, Special WA.	Fatty alcohol sulfate
Glyceryl Monostearate	

Product	*Composition*
Halo	Sulfate of mixed fatty acid monoglycerides
Hamico 169	Sulfonated ester
Hartex Oil K-40	Sulfated oils + solvents
Hartex Oil L-33	Glycol soaps + alkali
Hartolein K-122	Pine oil soap + alkali
Hartopene	Pine oil gel
Hornkem 1	Processed waste sulfite liquor
Hornkem 3	Hornkem 1 + wetting agents
Hornkem 31	Processed waste sulfite liquor
Hydroxyethyl ethylene diamine Soap	
Igepal C	Polymerized ethylene oxide condensate
Igepon AP Extra	Oleic acid ester of long chain aliphatic
Igepon T	$C_{17}H_{33}CONHC_2H_4SO_3Na$
Integritol	Mixed sulfonated oils, esters, alcohols
Intramine	Sodium salt of sulfonated lauryl and myristyl collamide
Invadine B.C.N.	Sodium alkyl phenylene sulfonate
Lamepon A	Protein fatty acid condensate
Lamepon 4C	Same
Lamepon 10-N	Protein fatty acid condensate
Lanitol P	Sodium alkyl aryl sulfonate
Lanitol S	Sodium alkyl aryl sulfonate + alkali
Lanole B	Sodium oleate + solvents
Lauramine	
Leonil SA	Naphthalene sulfonic acid derivative
Loupene	Sulfonated oils & solvents
Loupole W-950	Sulfonated oils & solvents
Maprofix	Sulfated fatty alcohol
Mapromin	Same
Mapromol	Same
Mercerol	

Product	*Composition*
Merpentine	Sodium alkyl naphthalene sulfonate
Merpol B.C.	Alcohol sulfate
Methylcyclohexanol	
Modinal D, ES	Fatty alcohol sulfate
Monostearin	Glyceryl monostearate, special
Monosulph	Sulfonated castor oil
Naccolene F	Modified alkyl aryl sulfonate
Nacconol E	Sodium alkyl aryl sulfonate
Nacconol EP	Same
Nacconol NR	Same
Nacconol NRNO	Same
Nacconol NRSF	Same
Naccosol A	Sodium alkyl naphthalene sulfonate
Nekal A, BX	Sodium alkyl naphthalene sulfonate
Neomerpin N	Alkyl naphthalene sulfonic acid
Neomerpin VD	Sodium alkyl naphthalene sulfonate
Nonaethyleneglycol oleate	
Nopco 1935	Sulfonated oil, vegetable type
Nopco 1967	Sulfonated alkyl hydrocarbon
Nopco DID	Sulfonated fatty amine
Novonacco	Modified sodium alkyl naphthalene sulfonate
Novonacco NN	Modified alkyl naphthalene sulfonic acid
N.S.A.E.	Alkyl naphthalene sulfonic acid ester
Nusope 33A, P50	Alkali soap of naphthenic acids
Oleo Glyceryl Sulfate C, O	Oil ester sulfate
Onyxol 66	Same
Orthocen	Sulfonated higher phenol
Orvus	Fatty alcohol sulfate
Para Oil	Saponified oils
?emeko	Sulfated alcohol
netrolin AC	Sodium salt of alkylated naphthalene sulfonic acid

Product	*Composition*
Pentogen	Sulfated compound containing solvents
Phi-ϕ-Sol	Sulfonated oil ester
Phi-ϕ-Sol W.A.	Same
Pineol	Sulfonated oil + terpenes
Pyridine	
Quadrafos	Sodium tetraphosphate
Quaker 3-X	Sulfonated pine oil
Quaker 700-X	Sulfonated cresylic compound
Quaker Dianol D	Combination sulfonated higher alcohol & aldehyde condensates
Quaker Pro-So-Tex 55	Aromatic sodium sulfonate
Quaker Pro-So-Tex 58	Sulfonated petroleum derivative
Quaker Pro-So-Tex 75	Alkylated aryl sulfonate
Quix	Sulfonated fatty acid
Quixite	Sulfonated fatty acid
Radiactine	Algin soap compound
Rapidole H	Saponified sulfonated vegetable oils + solvents
Royox	Pine oil with soap
Sandozol G	Sulfonated fat
Sanol 1, S, T	Sulfonated aryl alcohols
Santomerse	Alkylated aryl sulfonate
Sapamine A	Diethyl aminoethyl oleyl amide acetate
Soapotol	Sulfonate derivative of higher alcohol
Solvadine NC Conc.	Alkylated aryl sulfonate
Stablex A	Naphthalene sulfonate
Stablex G	Petroleum sulfonate
Sulfanole K	Fatty amide sodium sulfonate + solvents
Sulfanole PB	Fatty amide sodium sulfonate
Sulfatate	Sulfonated hydrocarbon
Sulfonated Luxolene	Fatty ester sulfonate
Supergel T.B.	Soluble terpene sulfonate
Supersulfate F.S. Powder	Sulfated aryl alcohol

Product	*Composition*
Surpasol	Mixture of sulfonated oils, esters, alcohol
Teel	Fatty alcohol sulfate
Tenesol A, B, C, D, F concentrates.	Sulfonated ethers
Tensol	Same
Tergitol Penetrant 4.7	Sodium salt of higher secondary alkyl sulfate
Tergitol Penetrant OS	Sodium salt of higher primary alkyl sulfate
Tergitol Penetrant 4T	Amine salt of higher secondary alkyl sulfate
Tetraethylene Pentamine Soaps	
Tetranol 1638	Sulfonated fatty ester
Tinapol Oil NE	Sulfonated ester
Tris (hydroxymethyl) aminomethane Soap	
Triton 720	Sulfonated ether
Triton 812	Condensed sulfonated ether
Triton E-40	Salt of sulfonated and sulfated ether
Triton E-79	Amine salt of sulfated ether
Triton K-12	Quaternary ammonium salt
Triton K-60	Same
Triton NE	Organic polyether alcohol
Triton W-30	Sulfated aromatic ether alcohol
Twitchell Base 262	Sodium sulfonates of mineral oil
Twitchell Base 265	Same
Twitchell Oil 3X	Same
Ultravon K, W	Sulfonated complex stearyl alkyl compound
Ultrawet 40, 4D (+ sodium sulfate)	Aromatic monosodium sulfonate
Ultroil	Sulfonated vegetable oil
Unitex	Alkylated aromatic sulfonate
Vel	Sulfate of mixed fatty acid monoglycerides

Product	*Composition*
W. A. 35A, B, C	Phosphorated higher alcohol $(octyl)_5Na_5P_6O_{20}$
W. A. 58	Phosphorated Higher alcohol $(capryl)_5Na_5P_6O_{20}$
Warcosol	Alkyl naphthalene sodium sulfonate
Warcosol 897	Hydrocarbon sodium sulfonate + solvent
Wetanol	Modified sulfated fatty acid ester
Wetonite	Sulfonated ester
Wetsit	Alkylated aromatic sulfonate
Xynomines	Sulfated boro-fatty acid amide
Yelkin C	Water-dispersible lecithin
Yelkin T	65–70% lecithin 30–35% soybean oil
Yelkin T-X15	Lecithin compound

CHAPTER VII

LIST OF EMULSIFYING AGENTS

Abrocol (Glyceryl monostearate)[1]
Acimul (A modified glyceryl monostearate used with weak acids)[2]
Agar[3]
Agar, pectin and gelatin[4]
Albasol (Sulfonated fats)[5]
Albatex BD (Sodium m-nitrobenzene sulfonate)[6]
Albumin[7]
Albumol (Complex albuminoid)[8]
Aldol urea reaction products[9]
Algin[10]
Alginic acid or sodium alginate[11]
Alkyl or aromatic esters of petroleum sulfonates[12]
Alkyl guanidine[12a]
Alkyl sulfates of high molecular weight[13]
Alkylaminoethane sulfonic acids[14]
Alkylene oxides, polymerized[15]
Alkylolamine esters, polymerized (e.g., Polymerized triethanolamine)[16]
Alronol 90 (Propylated amines)[17]
Alumina[18]
Alumina, activated gelatinous[19]
Alumina, powdered, or iron oxide gels[20]
Aluminum or calcium naphthenates[21]
Aluminum oxide, hydrated[22]
Aluminum palmitate[23]
Amide, acid[24]

Amide, borated alkyl-[25]
Amide, castor oil [26]
Amide, coconut oil [27]
Amide, oleic [28]
Amide, sperm oil [29]
Amide, stear-[30]
Amide, stearyl monoglycol [31]
Amide of substituted fatty acid [32]
Amide, sulfated alkyl-[33]
Amide, wool fat [34]
Amido fatty acid and sodium salts of their sulfates [35]
Amine, amidostearyl diethylene-[36]
Amine, castor oil [37]
Amine, coconut oil [38]
Amine, dibutyl-[39]
Amine, di-2-ethylhexyl-[40]
Amine, di-2-hydroxyethyl-[41]
Amine, dioctyl-[42]
Amine, ethylenedi-[43]
Amine, monoamyl-[44]
Amine, monobutyl-[45]
Amine, oleic [46]
Amine, tributyl-[47]
Amine, triethanol [48]
Amine, tri-2-hydroxyethyl [49]
Amine, triisopropanol [50]
Amino-alcohol and synthetic resin acid reaction product [illegible]
Amino alkyl phosphatidic acids [52]
2-Amino-2-ethyl-1, 3-propanediol [53]
2-Amino-3-hexanol [54]
2-Amino-2-isopropyl-1, 3-propanediol [55]
2-Amino-2-methyl-1-butanol [56]
2-Amino-2-methyl-3-hexanol [57]
2-Amino-2-methyl-1, 3-propanediol [58]
2-Amino-2-methyl-1, 3-propanediol oleate [59]
2-Amino-2-methylol-1, 3-propanediol stearate [60]
2-Amino-2-methyl-1-propanol [61]
2-Amino-1-pentanol [62]
2-Amino-2-propyl-1, 3-propanediol [63]
3-Amino-4-heptanol [64]

3-Amino-3-methyl-2-butanol [65]
3-Amino-2-methyl-4-heptanol [66]
3-Amino-3-methyl-4-heptanol [67]
3-Amino-3-methyl-2-pentanol [68]
Amino mineral oil sulfonate [69]
5-Amino-4-octanol [70]
Aminostearin (Modified amine soap) [71]
Ammonium laurate, anhydrous [72]
Ammonium laurate, conc., S [73]
Ammonium laurate S [74]
Ammonium linoleate [75]
Ammonium linoleate paste S [76]
Ammonium oleate [77]
Ammonium resinate [78]
Ammonium salt of sulfonated shale oil [79]
Ammonium salts, long chain quaternary, e.g., ammonium chloride and water soluble cellulose ethers [80]
Ammonium salt of phosphated castor oil [81]
Ammonium shale oil sulfonate [82]
Ammonium stearate, anhydrous [83]
Ammonium stearate paste S [84]
Ammonium sulfoicthyolate [85]
Ammonium sulfoleate [86]
Ammonium sulfonates [87]
Amoa (Reaction product of caustic potash or casein) [88]
Antimony trichloride [89]
Aqualoid (Lecithin hydrate and 10% alcohol) [90]
Aquamel (Animated hydrocarbon) [91]
Aquaphil [92]
Aquasol (Highly sulfonated castor oil) [93]
Arctic Syntex A (Oleic acid ester of an aliphatic compound sodium sulfonate) [94]
Arctic Syntex T ($C_{17}H_{33}.CO.NCH_3.C_2H_4SO_2Na$) [95]
"Areskap" (Neutral salt of sulfonated butyl diphenyl compound) [96]
"Aresket" (Neutral salt of sulfonated butyl diphenyl compound) [97]
"Aresklene" (Neutral salt of sulfonated butyl diphenyl compound) [98]

Arkol base (Olive oil emulsifying base)[99]
Asphalt[100]
Asphalt resin or petroleum tar[101]
Barium oleate[102]
Base 2210 (Naphthenic and petroleum sulfonate soap)[103]
Betramine (Sulfonation product of a high molecular aliphatic aldehyde condensation)[104]
Bile[105]
Blendene[106]
Blood albumin, casein or other protein, hydrolyzed and treated with alkali[107]
Blood serum with or without lecithin[108]
n-Butylamine[109]
Caesium oleate[110]
Calcium carbonate, calcium arsenate, lead arsenate, zinc oxychloride, basic zinc chloride, Oxford clay, ferrous hydrosulfide or glycerin[111]
Calcium ceryl sulfonate[112]
Calcium chloride and borax[113]
Calcium ricinoleate[114]
Calcium triricolein phosphite[115]
Carasol (Sulfonated oil)[116]
Carbitol citrate[117]
Carbon black[118]
Carbosterol (Carbitol stearate)[119]
Carob bean extract and alkali[120]
Casein[121]
Casein, alkaline, with soap[122]
Cellulose, alkylated[123]
Ceryl potassium sulfate[124]
Cetyl acid sulfate[125]
Cetyl alcohol with sodium lauryl sulfate[126]
Cetyl dimethylaminoacetate hydrobromide[127]
Cetyl or stearyl alcohols[128]
Cetyl or stearyl alcohol with resin alcohol and water[129]
Chlorinated fatty acids with strong alkalies[130]
Chlorinated oil soluble petroleum sulfonate soap[131]
Cholestenone sulfonate salts[132]
Cholesterol[133]

Cholesterol betaine hydrochloride [134]

Cholesterol, isocholesterol, metacholesterol, oxycholesterol, lanolin alcohol, ceryl alcohol, carnaubyl alcohol, cetyl alcohol and lanolin [135]

Cholesterol laurate [136]

Cholesterol or oxycholesterol and albumins [137]

Cholesterol stearate [138]

Clay, colloidal, with calcium silicate [139]

Coal, brown, or peat [140]

Colloresin (Methyl cellulose) [141]

Condensation product of aminoguanidine with higher fatty acids [142]

Condensation product of 1-chloronaphthalene with formaldehyde [143]

Condensation product of α-diethylamino-β-hydroxypropylamine with oleic or stearic acid; α-diethylamino-β-hydroxy-α-phenylaminopropane with oleic or stearic acid chloride [144]

Condensation product of fatty acid halides and albumin decomposition products [145]

Condensation product of oleic acid and ethylene oxide [146]

Condensation product of secondary or tertiary hydroxyalkylamines and aromatic acids, e.g., triethanolamine benzoate [147]

Condensation products of starch, dextrin or cellulose with stearic, palmitic, oleic or linoleic acid [148]

Condensation product of sulfated mineral oil fraction with monohydric saturated alcohol [149]

Copper resinate [150]

Cresol linoleic or phenololeic acids [151]

Cyclic urethans [152]

Cyclono (Methyl cyclohexanone glyceryl acetal) [153]

Cyclopon A and GA (Fatty acid amide alkylsulfonate) [154]

Deceresol A Y (Sodium salt of diamylsulfosuccinate, U.S.P. 2,028,091) [155]

Deceresol M A (Sodium salt of dimethylamylsulfosuccinate, U.S.P. 2,028,091) [156]

Deceresol O S (Sodium salt of diisopropylnaphthalenesulfonic acid) [157]

Deceresol OT (Sodium salt of dioctylsulfosuccinate, U.S.P. 2,028,091) [158]

Dicholesteryl phosphate [159]

Diethanolamine naphthenate [160]
Diethylaminoethanol [161]
Diethylaminoethanol [162]
Diethylene glycol glyceryl monooleate [163]
Diethylene glycol glyceryl monoricinoleate [164]
Diethylene glycol monolaurate (Diglycol laurate neutral)[165]
Diethylene glycol monooleate [166]
Digitonin [167]
Diglycol laurate S [168]
Diglycol oleate [169]
Dihydric alcohol completely esterified with a higher fatty acid and containing free fatty acid [170]
Dimethylcyclohexylamine oleate [171]
Distearin (Glyceryl distearate)[172]
Dodecyl, cetyl or octadecyl pyridinium trialkylammonium halides [173]
Duponol G (Long chain alcohol sulfonate)[174]
Duponol OS (Oil soluble alkyl sulfate)[175]
Duponol OS (Oil soluble alkyl sulfate)[176]
Duponol WS (Oil soluble alkyl sulfate)[177]
Egg yolk [178]
Egg yolk powder and alkaline casein [179]
Emulgor A [180]
Emulphor AG oil soluble [181]
Emulphor or methyl cellulose [182]
Emulsifier L (Phosphate compound with wetting agent) [183]
Emulsifier 157 [184]
Esters of abietic acid [185]
Esters of montan wax [186]
Ethanolamine [187]
Ethanolamine sulfonates [188]
Ethylene glycol monolaurate [189]
Ethylene glycol monooleate [190]
Ethylene glycol monostearate and stearate soap [191]
Ethylene oxide, polymerized [192]
Ethylene polymer with triethanolamine potassium oleate [193]
Extract of oak bark [194]
Fastolac (Mixture of vegetable gums)[195]
Fatty acids having better emulsifying properties than neutral fats or synthetic fatty acid esters [196]

Ferric oxide, colloidal [197]
Filtra blend (Purified petroleum sulfonates) [198]
Fish roe [199]
Floex (Condensation product of higher fatty acids) [200]
Fructose+, mannitol+ or sorbitol monostearate [201]
Fuller's earth [202]
Galactose [203]
Galactose and pectin [204]
Galagum C (Refined vegetable carbohydrate) [205]
Gamboge [205a]
Gardinol LS (Sodium oleyl sulfate) [206]
Gardinol WA (Sodium lauryl sulfate) [207]
Gelatin [208]
Gelatin, deaminized [209]
Gelatin and urea [210]
GKS-5, a mixture of complex aromatic sulfonic acids and aromatic acids with aliphatic side chains [211]
Glucose monostearate [212]
Glue with pyridinium octadecylbromide [213]
Glue and starch [214]
Glycerides, mono- or di-, of higher fatty acids [215]
Glycerolated starch [216]
Glycerol higher fatty acid esters polymerized, e.g., diglycerol stearate [217]
Glycerophosphoric acid salts [218]
Glyceryl monohydroxystearate [218a]
Glyceryl monolaurate [219]
Glyceryl monooleate [220]
Glyceryl monoricinoleate S [221]
Glyceryl monostearate and diethylaminoethyloleylamide [222]
Glyceryl monostearate with diethylaminoethyl oleyl phosphate [223]
Glyceryl monostearate and soap [224]
Glyceryl oleate [225]
Glyceryl oleyl triricinoleate [225a]
Glyceryl (hexa, nona) ricinoleate [225b]
Glyceryl tartrate [226]
Glycol dioleate, polymerized [227]
Glycol distearate, polymerized [228]
Glycol glyceryl stearate or glycol glyceryl laurate [229]

Glycol monolaurate, polymerized [230]

Glycol monooleate, glyceryl dihydroxystearate, triethylene glycol monostearate [231]

Glycol monostearate, polymerized [232]

Glycosterin (Diglycol stearate U. S. 1,914,100) [233]

Gomagel (Modified vegetable protein) [234]

Gum acacia [235]

Gum dammar [236]

Gum ghatti, sodium oleate, sodium glycocholate, albumin and lipose [237]

Gum tragacanth [238]

Herrin milt [239]

Higher fatty or chlorinated fatty acids with acid Turkey red oil or other sulfated oils [240]

Higher fatty acid ester of sugars or sugar alcohols [241]

Humic acid or insoluble humic acid salts [242]

Hydrohexalin (Hydralin) and soap [243]

Hydromalin (Animated glyceride) [244]

Hyglin (Water soluble cellulose ether) [245]

Idrapid (Octohydroanthracene mesasulfonic acids) [246]

Igepal CA, CTA and CE (Polymerized ethylene oxide condensation product) [247]

Igepon A, Igepon T [248]

Igepon AP extra (Oleic acid ester of aliphatic compound) [249]

Igepon T [250]

Intramine (Sodium salt of sulfonated lauryl and myristyl collamide, U.S.P. 1,981,792) [251]

Iodine (Acts as an emulsifier for those water immiscible liquids in which its solutions exhibit particles under the ultramicroscope) [252]

Irish moss [253]

Iron oleate [254]

Iron tannate [255]

Isopropyl valerate with gum arabic and tragacanth [256]

Ivorit [257]

Kelgin (Sodium alginate) [258]

Kleebatt emulsifier [259]

Lamepon A (Condensation product protein derivative and fatty acids) [260]

Lanette wax SX [261]

Lanette wax SX, Lanette wax SXN (Mixture of fatty alcohols and emulsifying agent)[262]
Lanolin, solvent extract[263]
Lead oleate[264]
Lead salt of lauryl-1-sulfonate[265]
Lead sulfate[266]
Lecithin[267]
Lecithin and benzyl alcohol[268]
Lecithin and cholesterol[269]
Lecithin and diglycerides of higher fatty acids[270]
Lecithin hydrate[271]
Lecithin and lactic acid[272]
Lecithin, lysolecithin or lysocephalin[273]
Lecithin, oxidized[274]
Lecithin, oxidized soya bean[275]
Lecithin and methyl cellulose[276]
Lecithin and pine oil[277]
Lexinol (Lecithin and associated phosphatides)[278]
Lignin derivatives[279]
Linseed aqueous extract[280]
Lithium oleate[281]
Lorol (Lauryl alcohol)[282]
Lorol (Technical dodecyl (Lauryl) alcohol)[283]
Lupogum (Locust bean gum)[284]
Magnesium chloride and cotton wadding[285]
Magnesium oleate[286]
Magnesium resinate[287]
Mannide dilaurate[288]
Mannide dipalmitate[289]
Mannide monolaurate[290]
Mannide monomyristate[291]
Mannide monooleate[292]
Mannide monopalmitate[293]
Mannide monoricinoleate[294]
Mannide monostearate[295]
Mannitan dilaurate[296]
Mannitan laurate, modified[297]
Mannitan monolaurate[298]
Mannitan monolaurate, modified[299]

Mannitan monomyristate [300]
Mannitan monomyristate, modified [301]
Mannitan monooleate [302]
Mannitan monopalmitate [303]
Mannitan monopalmitate, modified [304]
Mannitan monoricinoleate [305]
Mannitan monostearate [306]
Mannitan monostearate, modified [307]
Mannitan oleate [308]
Mannitan tetralaurate [309]
Mannitan trilaurate [310]
Mannitol glyceryl hydroxystearate [310a]
Mannitol glyceryl monolaurate [311]
Mannitol glyceryl monooleate [312]
Manucol V (Sodium alginate) [313]
Maprofix powder, Maprofix paste (Sodium borosulfate of technical cetyl to octadecenyl alcohol) [314]
Mapromol powder, Mapromol paste (Sodium borosulfate of technical octadecenyl alcohol) [315]
Melissyl calcium phosphate [316]
Methocel (Methyl cellulose) [317]
Methyl cellulose [318]
Methyl cellulose and cetyl alcohol [319]
Methyl cellulose and lecithin [320]
Miscibol [321]
Modinal D paste (Long chain alcohol sulfate) [322]
Modinal ES paste (Sodium sulfate of technical octadecenyl alcohol) [323]
Modinal ES paste (Sodium oleyl sulfate) [324]
Monoaryl ethers of polyhydric alcohols with hydrotropic compounds of carboxylic or sulfonic acids of aliphatic, aromatic and hydroaromatic series [325]
Monoethanolamine linoleate [326]
Mono- or di- fatty acid glyceride and monofatty acid ester of glycols [327]
Monostearin [328]
Monostearin sulfoacetate [329]
Monostearyl esters of diethylene glycol, glycerol or diglycerol [330]

Monostearyl glucose [331]
Monostearyl glycerol, monostearyl diethylene glycol, dipalmityl glycerol [332]
Monostearyl mannitol [333]
Morpholine oleate [334]
Morpholine tetradecyl sulfate [335]
Myristic esters of polyhydric alcohols [336]
Nacconol NR (Sodium alkylaryl sulfonate) [337]
Naphtheic acids or acid naphthenic resin with caustic soda solution [338]
Nekal A (Sodium octohydroanthracene mesasulfonate) [339]
Nekal A E M [340]
Nekal BX (Sodium naphthalene sulfonate) [341]
Nekal S [342]
Nelgin (Modified colloidal silicate) [343]
Neomerpin [344]
Neomerpin N [345]
Nonaethylene glycol abietate, laurate, oleate or stearate [345a]
Nopco 1216-K [346]
Noremulsol [347]
Ocenol (Technical oleyl alcohol) [348]
Octadecylamine soaps, adipyl, glycolyl or levulinyl [348a]
Octylamine [349]
Oil, Ahco base (Sulfonated compound) [350]
Oil, base S-763A (Sulfonated mineral oil) [351]
Oil or fat, phosphated or acetyl phosphated [352]
Oil monopole (Double sulfonated castor oil) [353]
Oil, oxidized coal tar oil [354]
Oil, oxidized or polymerized vegetable and polyhydric alcohols partially esterified with higher fatty acids [355]
Oil, oxidized soya bean [356]
Oil, sunflower, oxidized [357]
Oil, Turkey red [358]
Oil, Turkey red, and diammonium hydrogenphosphate [359]
Oleo glyceryl sulfate (Highly sulfated glyceryl fatty esters) [360]
Oleyl or sulfonated fatty alcohols [361]
Olibanum [361a]
Oxycholesterol [362]
Palmityl glycine [363]
Palmityl and stearyl alcohols [364]

Paremulsol [365]
Pectin and fructose, sucrose and mannose [366]
Pectin or hemicellulose [367]
Pectin, milk, and sugar [368]
Petronate (Sodium sulfated naphthenates) [369]
Pharmagel (Specially refined gelatin) [370]
Phosphated higher fatty alcohols [371]
Phosphoproteins [372]
Phosphoproteins, globulin, or albumin [373]
Phosphoric acid esters of higher molecular weight [374]
Phosphosol [375]
Phosphotex [376]
Phytosterols [377]
Piperidine or organic acids [378]
Pluratex (Alkylaryl sulfonate) [379]
Polyglycerol fatty acid esters [380]
Polyglycerol fatty ethers, e.g., diglycerol monolaurate [381]
Polyhydric alcohol partially esterified with fatty acid amino products [382]
Polyhydric alcohol partially esterified with higher fatty acid and an alkali [383]
Polyhydric alcohol partially esterified with a higher fatty acid and containing free fatty acid [384]
Polyhydric alcohol partially esterified with a higher fatty acid and sodium salt of a sulfated higher fatty alcohol [385]
Polymerized glycol higher fatty acid ester, e.g., polyglycol stearate [386]
Polysulfonates of aromatic polyalkylene ethers [387]
Polyvinyl alcohol [388]
Polyvinyl alcohol [389]
Polyvinyl alcohol sulfate [390]
Potassium abietate [391]
Potassium cetyl sulfoacetate [392]
Potassium chaulmoograte [393]
Potassium naphthenate [394]
Potassium oleate [395]
Potassium palmolate [396]
Proflex [397]
Proflex or hydromalin [398]
Prolaurin (Propylene glycollaurate) [399]

Propyl or butyl aromatic sulfonic acids [400]
Propylene glycol monolaurate [401]
Propylene glycol monooleate [402]
Propylene glycol monoricinoleate [403]
Propylene glycol monostearate [404]
Protegin [405]
Proteins, alkaline animal or fish [406]
Proteins (hydrolyzed with alkali) [407]
Protex gel (Aliphatic laurylamide sulfonated alkylbenzimidazol) [408]
Quaternary ammonium derivative of amino alcohol compound [409]
Reaction product of an aminocarboxylic acid with an isocyclic carboxylic acid [410]
Reaction product of polyvinyl alcohol and an aldehyde [411]
Reaction product of a saponifiable wax or fat with a nitrogenous base [412]
Reaction product of shellac with a nitrogen containing base, e.g., ammonia or methylamine [413]
Reaction products of substituted thiocyanates and substituted amino acids [414]
Red lead [415]
Rosin or wax with polyglycerol monocarboxylic ester [416]
Rosoap A [417]
"Santomerse" (Alkyl aryl sulfonate) [418]
Sapamine [419]
Sapamines KW, MS (Salts of amides derived from higher fatty radicals) [420]
Sapogenin, betulin, ursolic, or oleanolic acid or their salts [421]
Saponin [422]
Saponin and alkali [423]
Saponin and borax or ammonium carbonate [424]
Saponin and methyl cellulose [425]
Serum [426]
Sherosope (Sodium sulfonaphthenate) [427]
Silica, clay or iron oxide [428]
Soap, amine [429]
Soap, n-butyl amine [430]
Soap, castile [431]
Soap, n-dibutylamine [432]

Soap, 2-ethylhexylamine [433]
Soap, guanidine [434]
Soap, halogenated fatty acid [435]
Soap, hydroxyalkylamine (Ethanolamine) [436]
Soap, metallic [437]
Soap, myristic acid [438]
Soap, naphthenic [439]
Soap and polyhydric alcohol partially esterified with higher fatty acid [440]
Soap, potassium triethanolamine [441]
Soap, sodium triethanolamine [442]
Sodium abietate [443]
Sodium alkyl naphthalene sulfonates [444]
Sodium cerotate [445]
Sodium cetyl phosphate [446]
Sodium cetyl sulfonate [447]
Sodium cholate [448]
Sodium cholate [449]
Sodium cholesteryl sulfoacetate [450]
Sodium cymene sulfonate [451]
Sodium elaidate [452]
Sodium fatty alcohol sulfonate and G-cetyl betaine [453]
Sodium glycocholate [454]
Sodium glycol monooleate sulfate [455]
Sodium heptadecyl sulfate [456]
Sodium isopropylnaphthalene sulfonate and bone glue [457]
Sodium lauryl sulfate [458]
Sodium metasilicate [459]
Sodium myristate or sodium palmitate [460]
Sodium naphthenate [461]
Sodium oleate [462]
Sodium oleate, sodium myristate, sodium ricinoleate, sodium stearate, sodium resinate [463]
Sodium petroleum sulfonate [464]
Sodium polyacrylate [465]
Sodium, potassium, ammonium or calcium gluconate [466]
Sodium ricinoleate [467]
Sodium salt of sulfonated stearic acid anilide [468]
Sodium silicate [469]
Sodium stearate [470]

Sodium tetradecyl sulfate [471]
Sorbide dilaurate [472]
Sorbide monolaurate [473]
Sorbide monomyristate [474]
Sorbide monooleate [475]
Sorbide monopalmitate [476]
Sorbide monoricinoleate [477]
Sorbide monostearate [478]
Sorbitan dilaurate [479]
Sorbitan monolaurate [480]
Sorbitan monomyristate [481]
Sorbitan monooleate [482]
Sorbitan monopalmitate [483]
Sorbitan monoricinoleate [484]
Sorbitan monostearate [485]
Sorbitan sulfonated ricinoleate [486]
Sorbitan tetralaurate [487]
Sorbitan tetrastearate [488]
Sorbitan trilaurate [489]
Sorbitol dilaurate [490]
Sorbitol dioleate [491]
Sorbitol distearate [492]
Sorbitol glyceryl monolaurate [493]
Sorbitol glyceryl monolaurate S284 [494]
Sorbitol glyceryl monolaurate S285 [495]
Sorbitol glyceryl monooleate S282 [496]
Sorbitol glyceryl monooleate S283 [497]
Sorbitol glyceryl monostearate [498]
Sorbitol laurate [499]
Sorbitol oleate [500]
Sorbitol stearate A [501]
Soya bean meal and caustic potash [502]
Soya bean phosphatides [503]
Soybean protein [504]
Starch, dextrin, casein, Irish moss, sodium silicate or latex [505]
Stearyl or cetyl alcohol and mixture of sodium salts of their sulfonates [506]
Stearyl glutamic acid [507]
Stearyl sucrose [508]
Stenol (Mixture of stearyl and cetyl alcohols) [509]

Sterols [510]
Strontium oleate [511]
Sucrose [512]
Sucrose, glucose or mannitol partially esterified with fatty acids [513]
Sucrose oleate [514]
Sugar house scum [515]
Sulfanole C. P. (Alcohol fatty derivative) [516]
Sulfanole P. B. (Aliphatic fatty derivative) [517]
Sulfated fatty alcohol [518]
Sulfated monoglycerides [519]
Sulfated oleyl acetate [520]
Sulfite [521]
Sulfite cellulose lye [522]
Sulfite liquor [523]
Sulfite liquor, aliphatic or aromatic sulfonic acids [524]
Sulfo dicarboxylic acids, e.g., octyl disulfosuccinic, etc.[525]
Sulfo fatty aromatic acids [526]
Sulfonates, alkali, high molecular, e.g., sodium tetrahydronaphthalene-β-sulfonate [527]
Sulfonate, petroleum [528]
Sulfonated cocoa butter or stearin [529]
Sulfonated distillation product of glycol and olive oil [530]
Sulfonated fatty acids [531]
Sulfonated fatty hydroxy acid esters [532]
Sulfonated higher fatty acids [533]
Sulfonated hydrogenated castor oil [534]
Sulfonated hydrogenated castor oil, ammonium salt [535]
Sulfonated hydrogenated castor oil, isopropylamine [536]
Sulfonated hydrogenated castor oil, potassium salt [537]
Sulfonated hydrogenated castor oil, sodium salt [538]
Sulfonated hydrogenated caster oil, triethanolamine [539]
Sulfonated oil, castor [540]
Sulfonated oil, coconut [541]
Sulfonated oil, fish, egg, apricot, peach-kernel, almond or teaseed [542]
Sulfonated oil, mineral and benzol [543]
Sulfonated oil, mineral, condensed with alcohols [544]
Sulfonated oils, oxidized, e.g., oxysulfoleic acid [545]
Sulfonated oil, palm [546]

Sulfonated oil, red [547]
Sulfonated oil, Turkey red [548]
Sulfonated oleylbutyrate or other sulfonated higher fatty alcohol esters [549]
Sulfonated polymerized oils, fats or fatty acids [550]
Sulfonated propylene glycol ricinoleate [551]
Sulfonated spermaceti, beeswax or woolfat [552]
Sulfonated squalene [553]
Sulfonated stearic or palmitic acids [554]
Sulfonated stearin pitch [555]
Sulfonated stearin pitch [556]
Sulfonated tallow [557]
Sulfonated wool fat fatty acids [558]
Sulfonic acid, aromatic, with at least one alkyl group and a light metal salt [559]
Sulfonic acid, substituted aromatic, e.g., amyl naphthalene-β-sulfonic acid [560]
Sulfonic acid, unsaturated [561]
Sulfuric esters of amides or anilides [562]
Sulfuric ester of higher fatty alcohol [563]
Tegacid [564]
Tegin (glyceryl monostearate) [565]
Tegin P (Propylene glycol monostearate) [566]
"Tergitol" penetrant (Sodium sulphate of higher alcohol) [567]
Tetraethylene glycol stearate [567a]
Tetrahydronaphthalene sulfonic salts [568]
Tetrasodium pyrophosphate (Anhydrous powder & flakes) [569]
Thoreps [570]
Triethanolamine [571]
Triethanolamine and other alkylolamines [572]
Triethanolamine condensed with stearic sulfonic or sulfonated carboxylic acids [573]
Triethanolamine naphthenate [574]
Triethanolamine (mono, di or tri) laurates [574a]
Triethanolamine stearate [575]
Triethanolamine tetradecyl sulfate [576]
Trigamine [577]
Trigamine stearate [578]
Triglyceride, partially saponified, containing soap, e.g., glyceryl mono- and distearate [579]

Trihydroxyethylamine stearate [580]
Trihydroxyethylamine stearate, special [581]
Trimethylamine [582]
Trimethylol aminomethane [583]
Triton NE (High molecular weight complex alcohol) [584]
Triton W-30 (Sulfated aromatic ether alcohol) [585]
Triton K-60 (Cation active quaternary salt) [586]
Triton 720 (Sulfonated ether) [587]
Triton E-79 (Amine salt of a sulfated ether) [588]
Turkelene [589]
Turpentine, spruce [590]
Tylose (Methyl cellulose) [591]
Urethane oleate [592]
Urethane oleate (Cyclic) [593]
Ursolic acid [594]
Vaneps [595]
Warcosol (Alkyl naphthalene sulfonate) [596]
Wax, saponifiable, e.g., montan, I. G., carnauba, Rilan; with borax or ammonium bicarbonate [597]
Whey protein [598]
Wool fat and phenol, sulfonated [599]
Xerol (Glyceryl monostearate) [600]
Xynomine powder, Xtnomine paste (Sulfated boroamide ester of aliphatic compounds containing 12 to 18 carbon atoms, U. S. 1,918,373) [601]

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CHAPTER VIII

LIST OF EMULSIONS

Acriflavine, petrolatum and mineral oil, with wool fat [1]

Acrylic nitrile and butadiene, with diethylamine-ethoxyoleylanilide hydrochloride [2]

Acrylic nitrile and butadiene, with sodium oleate [3]

Alcohol, with potassium-cupric tartrate [4]

Aliphatic or hydroaromatic alcohols, ketones, hydrocarbons, higher oleic acid or other fatty substances, aromatic bases or dyes with sodium dicresyl phosphate [5]

Amide, octadecyl, myristyl, or lauryl, with stearic acid and sodium silicate [6]

Amides, higher fatty, (e.g., stearamide), with sodium silicate and a higher fatty acid [7]

Amyl acetate and boric acid, with "Emulgor-A" [8]

Amyl alcohol, amyl acetate or ethylacetate, with iodine [9, 10]

Aniline or dimethylaniline, with soap [11]

Aromatic principles, with ammonium sulforicinoleate [12]

Asphalt, with alkali and alkaline casein [13]

Asphalt, with alkali and clay [14]

Asphalt, with alkali phosphatides [15]

Asphalt with alkali and soap or clay [16]

Asphalt, with alkali tannate [17]

Asphalt, with aluminum hydroxide and asbestine [18]

Asphalt, with ammonia and casein [19]

Asphalt, with bentonite [20]

Asphalt, with colloidal clay and anhydrous soap and olein [2]

Asphalt, with colloidal hydrous magnesium silicate [22]

Asphalt, with fatty acid and sodium or potassium carbonate [23]

Asphalt, with ferrous sulfate, potassium tannate and potassium caseinate [24]

Asphalt, with flaxseed mucilage [25]

Asphalt, with gelatin or glue [26]

Asphalt, with gelatin and salts [27]

Asphalt, with glue and soap [28]

Asphalt, with green petroleum acid soap and corn gluten, or soya-bean meal [29]

Asphalt, with "Kontakt" or naphthenic acid [30]

Asphalt, with montan wax and caustic soda [31]

Asphalt, with naphthenic soap [32]

Asphalt, with oleic acid and borax or sodium silicate [33]

Asphalt, with oxidized paraffin wax soap [34]

Asphalt, with potassium tannate or caseinate [35]

Asphalt, with silica gel [36]

Asphalt, with soap and bentonite [37]

Asphalt, with soap or clay [38]

Asphalt, with soap and colloidal clay [39]

Asphalt, with soap, electrolytes or colloids [40]

Asphalt, with sodium abietate [41]

Asphalt, with sodium cresylate [42]

Asphalt, with sodium fatty alcohol sulfonates [43]

Asphalt, with sodium petroleum sulfonate [44]

Asphalt, with sodium phosphate [45, 46]

Asphalt, with sodium or potassium peroxide or percarbonate [47]

Asphalt, with sodium silicate and oleic acid [48]

Asphalt, with soya bean flour [49]

Asphalt, with starch, borax [50]

Asphalt, with starch or dextrin and alkali [51]

Asphalt, with stearin pitch and caustic soda [52]

Asphalt, with sulfate lignin and metallic salts [53]

Asphalt, with tannic acid or synthetic tannin [54]

Asphalt, with triethanolamine oleate and a salt [55]

Asphalt, with trisodium phosphate [56, 57, 58]

Asphalt, with wax acid metallic soap and caustic soda [59]

Asphalt, bitumen, coal-tar pitch, cresol or dead oil, with loam, soil or clay [60]

Asphalt and carbon tetrachloride, with colloidal clay [61]

Asphalt, cumarone resin and montan wax, with sodium or potassium hydroxides and methyl cellulose [62]

Asphalt and fatty acid, with alkali silicate or alkali borate [63]

Asphalt, fatty acids, oil or tar, with humic acids or humates [64]

Asphalt and fuel oil, with soap and metallic soap [65]

Asphalt and gasoline, with soap [66]

Asphalt, glycerides and mineral oil, with potassium soap [67]

Asphalt and montan wax, with alkali [68]

Asphalt or other bituminous material, with protein (casein), starch or oleic acid and alkali [69]

Asphalt or pitch, with bentonite and acid [70]

Asphalt or pitch, with naphthenic or fatty acid soap [71]

Asphalt or pitch, with petroleum and alkali [72]

Asphalt, pitch, and petroleum, with lead oxide [73]

Asphalt or pitch, with sulfonated fatty oils [74]

Asphalt or pitch, with sulfonated mineral oil [75]

Asphalt, pitch or rubber, with viscose [76]

Asphalt, pitch or tar, with colloidal clay and magnesium-oxide or hydroxide [77]

Asphalt residue or bitumen, with soap, rosin soap or rosin oil soap [78, 79]

Asphalt, resins, mineral oil, tar, vegetable or animal oils, with sulfonated fatty acids [80]

Asphalt and rosin oil, with sodium abietate [81]

Asphalt, rosin and petroleum pitch, with Turkey red oil [82]

Asphalt or tar, with cholesterol or soap [83]

Asphalt or tar, with lecithin or other phosphatides [84]

Asphalt, tar or pitch, with oil cake and alkali [85]

Asphalt, wax tailings and rosin, with colloidal clay [86]

Bakelite C-9 resins, with casein and ammonia and morpholine [87]

Balsam Peru with soap bark and saponin [88]

Beeswax, with potassium carbonate [89]

Beeswax and p-cymene, with ethyl cellulose [90]

Bees, Japan, or montan wax, with potassium carbonate [91]

Beeswax, stearine and ether, with ammonia [92]

Benzene with agar, saponin, albumin, pectin, gelatin, lecithin or casein [93]

Benzene, with castor oil soap, sodium oleate or coconut oil soap or kaolin [94]

Benzene, with colloidal ferric hydroxide [95]

Benzene, with methanol, ethanol, allyl alcohol, phenol, resorcinol or higher fatty acids [96]

Benzene, with phenol or resorcinol [97]

Benzene, gasoline, naphtha, or kerosene, with trihydroxyethylamine stearate [98]

Benzene and latex, with soap [99]

Benzene, nitrobenzene, chloroform or carbon tetrachloride and cottonseed oil, with gelatin [100]

Benzene, toluene, xylene, aniline, o-toluidine, nitrobenzene or dimethylaniline, with soap [101]

Benzine, with saponin [102]

Benzine and beeswax, with caustic soda and soap [103]

Benzine, benzene, petroleum, toluene, xylene, tetralin, decalin, hexalin, methyl hexalin, carbon tetrachloride or trichlorethylene, with Turkey red oil, Monopole oil, ammonium oleate, triethanolamine, Lanette Wax SX, or Betan (sodium β-tetralin sulfonate) [104]

Benzine and benzol, with soap [105]

Benzine or mineral oil, with "Savonade" (methyl hexalin and potassium oleate) [106]

Benzine or trichlorethylene with acidified carrageen, agar or Irish moss [107]

Benzoic-phthalic glyceride, with ammonia and gum arabic or gum tragacanth or Irish moss [108]

Bitumen, with acid sulfonated oil and alkali [109]

Bitumen, with alkali hydrolyzed glyceride [110]

Bitumen, with alkaline sulfonated oil [111]

Bitumen, with alkali salts of α or β naphthols, pyrogallol, resorcinol or carbazol [112]

Bitumen, with alkali tannate [113]

Bitumen, with bentonite [114]

Bitumen, with bentonite and calcium caseinate [115]

Bitumen, with blood [116]

Bitumen, with borax [117]

Bitumen, with calcium oxide and alum [118]

Bitumen, with calcium resinate and sodium resinate [119]

Bitumen (asphalt), with casein and alkali [120]

Bitumen, with chlorinated tall oil [121]

Bitumen, with formaldehyde phospho-protein condensation [122]

Bitumen, with humic acid and salt [123]

Bitumen, with humic or lignic acid [124, 125]

Bitumen, with hydrochloric acid and caustic soda [126]

Bitumen, with iron, aluminum or chromium sulfate and waste sulfate liquor [127]

Bitumen, with iron hydroxide, aluminum hydroxide, xinc hydroxide, basic magnesium salts or alkaline starch [128]

Bitumen, with lignic acid or oxidized tar extract [129]

Bitumen, with naphthenic or rosin soap and casein [130]

Bitumen, with protein or starch [131]

Bitumen, with rosin and alkali [132]

Bitumen, with rosin soap and milk [133]

Bitumen, with rosin soap and molasses [134]

Bitumen, with rubber latex [135]

Bitumen, with soap and alkaline casein and anthracene oil or creosote [136]

Bitumen, with soap and calcium resinate [137]

Bitumen, with soap and casein [138, 139]

Bitumen, with soap and gelatin [140]

Bitumen, with sodium hydroxide and sodium phenate [141]

Bitumen, with sodium oleate [142]

Bitumen, with sulfite liquor concentrate [143]

Bitumen, with sulfurized oils or sulfurized fatty acids [144]

Bitumen, with tall oil soap [145]

Bitumen, with water or alkali soluble phenol formaldehyde condensation [146]

Bitumen, with water swelling gum [147]

Bitumen or asphalt, with latex [148]

Bitumen or asphalt, with starch and alkali [149]

Bitumen, asphalt, petroleum or coal tar, with soap or rosin soap [150]

Bitumen and benzine, with barium chromate suspended in hot water [151]

Bitumen and gasoline, with potassium dichromate [152]

Bitumen or oil, with rubber latex [153]

Bitumen or pitch, with clay [154]

Bitumen, resin or wax, with sodium silicate [155]

Bitumen, resin and wax, with sulfite cellulose extract [156]

Bitumen, tar, creosote, or petroleum, with alkaline casein or alkaline blood albumin [157]

Bitumen, tar or pitch, with casein, rosin and caustic soda [158]

Bitumen and turpentine, with sodium hydroxide [159]

Bitumen and Vinsol resin, with alkali [160]

Borneol, terpene oil, fenchyl alcohol, with soft soap [161]

Butadiene, with diethylaminoethyloleylamide hydrochloride [162]

Butadiene, with (substituted) oleyl alcohol [163]

Butadiene, with saponin [164]

Butadiene, with sodium isoproplynaphthalenesulfonate [165]

Butadiene, with sodium and magnesium oleates [166]

Butadiene, with sodium oleate and magnesium oleate [167]

Butadiene, with sodium oleate, sodium isobutyl naphthalene sulfonate or albumin or diethylaminoethyloleylamide or 2-n-pentadecylglyoxalidine; sodium oleate [168, 169]

Butadiene, with sodium stearate [170]

Butadiene and butylene, with ammonia soap, glucosides or alginic acid [171]

Butadiene or isoprene, with salts of sulfonic or carboxylic acids or their amides [172]

Butadiene or isoprene, with sodium stearate [173]

Butadiene or styrene, with sodium stearate [174]

Butadiene and vinylidene chloride, with sodium oleate [175]

Butter, with egg white, gelatin, agar or gum arabic [176]

Butter, with lecithin [177]

Butter, with skim milk [178, 179]

Calcium sulforicinoleate, with gelatin or casein [180]

Camphor and acetaldehyde, with sodium oleate [181]

Carbon bisulfide, with alcohol and potassium oleate [182]

Carbon bisulfide, with potassium rosin fish oil soap or sodium rosin oleic acid soap [183]

Carbon bisulfide, with sulfonated castor oil [184]

Carbon bisulfide and butyl or amyl alcohol, with soap [185]

Carbon bisulfide or oils, with ammonia or amine and zinc, copper, or nickel hydroxide [186]

Carbon bisulfide and olein, with potash soap [187]

Carbon bisulfide and sulfur, with fish oil soap [188]

Carbon tetrachloride, with decylcarboxymethylisothiourea hydrobromide [189]

Carbon tetrachloride with triethylammoniumoleate [190]

Carbon tetrachloride, aniline, n-octanol, ethyl oleate, chloroform, benzene, toluene, xylene, higher paraffins, carbon bisulfide or hexane, with sodium oleate [191]

Carbon tetrachloride and benzene, with sodium oleate [192]

Carbon tetrachloride, benzene or camphor, with wool fat or sulfonated wool fat fractions [193]

Carbon tetrachloride, chloroform, benzene, turpentine, almond or mineral oil, with gum tragacanth, gum acacia or Irish moss [194]

Carbon tetrachloride and cyclohexanol, with ammonium oleate [195]

Carbon tetrachloride and light oils, with saponin, soap or gum arabic [196]

Carbon tetrachloride, tetrachlorethane, trichlorethylene, tetrahydronaphthalene, benzene or naphtha, with sodium or ammonium sulforicinoleates [197]

Carnuaba wax (bright drying), with alkanolamine soap [198]

Carnauba wax, with ammonia soap or glyceryl monostearate [199]

Carnauba wax, with morpholine oleate [200]

Carnauba wax, with soaps of monoethanolamine, diethanolamine, triethanolamine or morpholine [201]

Carnauba wax, with sodium and potassium stearates [202]

Carnauba wax, with trihydroxyethylamine-linoleate or stearate [203]

Carnauba wax and carbon tetrachloride, with lanolin and gelatin [204]

Carnauba wax and kerosene, with ammonium linoleate [205]

Carnauba and paraffin waxes, with starch [206]

Carnauba wax and resin, with soaps [207]

Carnauba wax and shellac, with borax and soap [208]

Castor, apricot or almond oils, with starch [209]

Cellulose nitrate and dibutyl phthalate, with gelatin [210]

Cetyl alcohol and shellac, with ammonia and triethanolamine [211]

2-chlorbutadiene, with diisobutyl-naphthalene sulfonate and sodium oleate [212, 213]

Chlorobutadiene, with sodium oleate, quaternary ammonium salts or sodium fatty alcohol sulfonates [214]

Chlorobutadiene, with sodium oleate or sulfonated castor oil [215]

Chloroform, with silver dichromate [216]

Chloroprene polymers, with C-cetyl betaine [217]

Chloroprene or styrene, with partially saponified polyvinyl acetate or partially saponified formaldehyde polyvinyl acetal [218]

Chlorothymol, with alkaline casein [219]

Chlorothymol, with rosin soap [220]
Chocolate, with lecithin [221]
Cocoa butter, with gelatin and methyl cellulose [222]
Cocoa butter, with lecithin, cholesterol or cetyl alcohol [223]
Copper oleate and butanol, with sodium acetate [224]
Copper, zinc, silver, calcium, manganese or cobalt resinates, with ammonia and casein, soy protein or gelatin [225]
Cresol, with linseed oil soap [226]
Cresol, with sodium stearate [227]
Cresylic acid, with soap [228]
Cresylic acid, phenol, o-cresol, m-cresol, p-cresol, with potassium oleate [229]
Cyclohexanol, with soap [230]
Cyclohexanol or methyl cyclohexanol and tetralin or decalin, with lecithin [231]
Dibenzanthracene, benzanthracene, dihydroanthracene or chrysene, with gelatin [232]
Dibenzanthracene and pyridin, with gum acacia [233]
Dibutyl phthalate, with bentonite and soap [234]
Dichlorbenzene, cresol and camphor oil, with sulfonated oils [235]
Diethylene glycol abietate, with "Duponal ME," sulfated castor oil and soap [236]
Diethyleneglycol abietate, "Abalyn," or "Hercolyn," with alkaline casein with or without sulfonated oil and Dupanol [237]
Diethylphthalate, with soap [238]
Dimethylerythrene, with soap [239]
Dimethyl sulfide, with calcium humate [240]
Diolefins, with milk, glue or gelatin [241]
Diolefins (e.g., butadiene), with proteids, milk, dextrin, soap or sulfonates [242]
Diolefins, with soap or sulfonic acid salts [243]
Dipentene, with sodium butylnaphthalene sulfonate or sodium isopropylnaphthalene sulfonate [244]
Dyes, with bentonite and casein [245]
Egg yolk substitute, with lecithin and improved with hydrogen peroxide [246, 247]
Erythrene, isoprene or butadiene and styrene, with sodium stearate [248]
Ethanol-stearamide, with sodium silicate and higher-fatty acid [249]

Ether, ethyl acetate, amyl acetate and amyl alcohol, with iodine [250]

Ethylenedichloride, with magnesium hydroxide, starch, gelatin, glue or albumin [251]

Ethylenedichloride, with potash fish-oil soap [252]

Ethylenedichloride, with sulfonated sperm oil [253]

Ethylenedichloride and oleic acid, with diglycol oleate and ammonia [254]

Ethylenedichloride or trichlorethylene, with Turkey red oil and bentonite [255]

Fat, with egg yolk [256]

Fat, with gelatin [257]

Fat, with malt or malt extract [258]

Fat, with powdered gum arabic or tragacanth [259]

Fat, animal, with lecithin and skim milk [260]

Fat, edible, with skimmed milk, lecithin and malt extract [261]

Fats, butter and vegetable, with skim milk [262]

Flax wax, with sodium oleate or ethanolamine [263]

Furfural, engine-, paraffin oil or kerosene, with bentonite [264]

Gasoline, with alginic acid, casein and sodium silicate [265]

Gasoline, with copper oleate and ammonium nitrate [266]

Gasoline, with petroleum sulfonic acid [267]

Gasoline, with soap [268, 269]

Gasoline, with sodium, ammonium or triethylammonium oleate [270]

Gasoline, with triethylammonium oleate [270]

Gasoline, ether, benzene, or chloroform, with wool fat fractions or their sulfonates [271]

Gasoline and eucalyptus oil, with soap [272]

Gilsonite, with tannic acid [273]

Gilsonite and hydrocarbon solvent, with glue [274]

Glyceryl phthalate (in solvent) with bentonite, soap or gelatin [275]

Glycol abietate, xylene and butanol, with sulfonated tallow and caustic soda [276]

Gum benzoin, with gum tragacanth [277]

Gum chicle, with bentonite, casein, sodium stearate, albumin, starch, flour or soap [278]

Gum, resin, rubber or wax and solvent with soap or sulfonated oil [279]

Gum sandarac, with ammonium oleate [279]

Gurjun balsam, with neutral sulfonated castor oil [280]

Heptane and carbon tetrachloride, with kaolin [281]

Hydrocarbons, with hydrocarbon sulfones and sulfonic acids [282]

Hydrocarbons, with naphthenic acids or naphthene sulfonic acids [283]

Hydrocarbons, oils or waxes, with one from each of two following groups: (A) protein, agar, saponin or bile; (B) starch, dextrin, rubber or vegetable glue [284]

Hydrocarbons or substituted hydrocarbons, e.g., trichlorethylene, with soap and silica gel [285]

Hydroxybiphenyl with Turkey red oil and diphenyl ether or guaiacol [286]

Isobornyl acetate, with methyl cellulose [287]

Isobutyl p-aminobenzoate (cycloform), with lanolin [288]

Isoprene, with ammonium oleate and casein [289]

Isoprene, with sodium or ammonium oleate or Turkey red oil [290]

Isoprene or butadiene, with albumin or soap or sodium isobutylnaphthalene sulfonate [291]

Isoprene and dibutyl fumarate, with Turkey red oil and sodium alkyl naphthalene sulfonate [292]

Isoprene and dimethylbutadiene, with albumin, gelatin or hemoglobin [293]

Isoprene or dimethyl butadiene, with ammonium or potassium oleate and casein or albumin [294]

Isoprene or erythrene, with diethylaminoethyloleylamide hydrochloride or diethylaminoethoxyoleylanide hydrochloride [295]

Japan wax, with soap [296]

Kerosene, with ammonium oleate [297, 298]

Kerosene (SO_2 extract), with arsenic compounds [299]

Kerosene, with butyl acetyl ricinoleate [300, 301]

Kerosene, with carbon black [302, 303, 304]

Kerosene with soap [305]

Kerosene, with sodium oleate, potassium stearate or potassium balmitate [306]

Kerosene, with sodium stearate [307]

Kerosene, and alkyl thiocyanates with triethanolamine oleate [308]

Kerosene or benzene, with arsenious sulfide or antimony trisulfide or silica [309]

Kerosene, and dibutyl phthalate, with soap [310]

Kerosene and linseed, with soap and starch [311]

Kerosene, olive or castor oil, with sodium oleate [312]

Kerosene or pine oil, benzine, toluene, or chlorinated solvents, with Dupanols [313]

Kerosene, pyrethrum and methyl salicylate, with soap [314]

Lacquer, with gum ghatti and sodium isopropylnaphthalene sulfonate [315]

Lacquer, with reaction product of ethylene oxide and castor oil [316]

Lanolin, with calcium icthosulfonate [317]

Lard, butter, or olive oil, with egg yolk or albumin [318]

Lard and hydrogenated cotton seed oil, with acid sodium stearate [319]

Lard or mineral oil, with soap [320]

Lard and sesame oil, with caustic potash [321]

Lead arsenate, with oleic acid and triethanolamine [322]

Lead arsenate, soya bean oil, with lime [323]

Lethane, with sulfite lye [324]

Methylbutadiene, with soap [325]

Methylmethacrylate, monomeric, with Turkey red oil and sodium diisopropyl naphthalene sulfonate [326]

Montan wax, with magnesium sulfate and sodium silicate [327]

Naphthalene, chlorinated, with hydrogenated naphthalene [328]

Naphthalene, chlorinated, and decahydronaphthalene with sulfite-cellulose extract [329]

Naphthalene, hydrogenated, with sulfonated fat or sodium alkylated aromatic sulfonate [330]

Nicotine, with soap [331]

Nicotine, derris or pyrethrum extracts, with sulfonated petroleum [332]

Nitrobenzene, with polyiodides and electric current [333]

Nitrocellulose, with pectin or agar [334]

Nitrocellulose, with soap, sulfated terpene, or higher alcohol, gelatin, Igepon or sulfonated castor oil [335]

Nitrocellulose, with sodium resinate or sodium lauryl sulfate [336]

Nitrocellulose and cyclohexanone, with sodium oleate [337]

Nitrocellulose lacquer, with gelatin or sodium oleate [338]

Nitrocellulose, resin and solvent, with soap gelatin or alkaline casein [339]

Nitrocellulose and solvents, with alizarin oil [340]

Nitrocellulose, solvents and oils, with magnesium, calcium or barium soaps and resins, e.g., dammar [341]

Nitrocellulose and wood creosote, with gum tragacanth [342]

Octane, with sodium oleate [343]

Oil, with ammonia soap [344]

Oil, with bentonite and soap [345]

Oil, with bentonite and vegetable gum [346]

Oil, with blood-albumen and ammonia [347]

Oil, with cetyl or stearyl alcohol and sulfated higher fatty alcohol sodium salt [348]

Oil, with lecithin [349]

Oil, with lecithin and hydrogen peroxide [350]

Oil, with silica, clay or iron oxide [351]

Oil, almond, with gum arabic and magnesium carbonate [352]

Oil, almond, and beeswax, with a higher aliphatic acid ester of an aliphatic polyhydroxy substance and an aliphatic polycarboxylic acid [353]

Oil, anthracene, with sulfite cellulose extract [355]

Oil, anthracene, or wood; or chlorine compounds, with bentonite [356]

Oil and bitumen, with acetylene [357]

Oil, blubber, with soda ash [358]

Oil, camphor with soap [359]

Oil, castor, with agar [360]

Oil, castor (blown), with ammonium ricinoleate [361]

Oil, castor, with gelatine [362]

Oil, castor, with gum acacia [363]

Oil, castor, with linseed and castor oil soap [364]

Oil, castor, with sodium hydroxide, or milk magnesia; gelatin and sugar [365, 366]

Oil, castor, with sodium hydroxide or potassium hydroxide [367]

Oil, castor, with tannin [368]

Oil, castor, almond, cod liver, cottonseed, linseed, olive, or sesame, with gum acacia [369]

Oil, castor, carbon disulfide and alcohol, with potassium hydroxide [370]

Oil, hydrogenated castor, with triethanolamine stearate [371]

Oil, castor, linseed, cod liver or cottonseed, with gum arabic [372]

Oil, castor (blown), and mineral oil, with ammonia [373]

Oil, castor and mineral, with pectin [374]

Oil, castor or olive, with morpholine [375]

Oil, castor, olive or cod liver, with soap or calcium or barium hydroxide [376]

Oil, castor, rapeseed, and turpentine, with ammonia [377]

Oil, coal tar, with sulfonated castor oil [378]

Oil, coal-tar, creosote, tar, petroleum, pitch, bitumen or asphalt, with casein, rosin and caustic soda or potash [379]

Oil, coconut, with casein and ammonia [380]

Oil, coconut, with flour or starch [381]

Oil, coconut, with gelatin [382]

Oil, coconut, with (skim) milk [383, 384]

Oil, coconut, with soap [385]

Oil, coconut, with soya bean phosphatide [386]

Oil, coconut, cottonseed or peanut, or butter, with cetyl alcohol and milk [387]

Oil, coconut or peanut, with polyglycerol ester, lecithin or glyceryl laurate [388]

Oil, coconut, and stearin, with milk [389]

Oil, coconut and "Vaseline," with caustic soda [390]

Oil, cod liver, with alkali metaphosphate [391]

Oil, cod liver, with calcium phosphorus organic complex and gum acacia [392]

Oil, cod liver, with gum arabic [393]

Oil, cod liver, with methylcellulose [394]

Oil, cod liver, with pectin [395]

Oil, cod liver, with protalbic acid [396]

Oil, cod liver, with protalbic acid, casein, calcium, saccharate egg yolk and lime water [396, 397, 398, 399]

Oil, cod liver, with soap, gum arabic and gelatin [400]

Oil, cod liver, with sodium metaphosphate, tragacanth and gum arabic [401]

Oil, cod liver, with sodium silicate and aluminum sulfate [402]

Oil, cod liver, or olive, with alkali casein [403]

Oil, cottonseed, with alkali soaps [404]

Oil, cottonseed, with gum acacia [405]

Oil, cottonseed (hydrogenated), with lecithin and triethanolamine [406]

Oil, cottonseed, with milk or gum arabic [407]

Oil, cottonseed, with pectin [408]

Oil, cottonseed and calcium carbonate, with "Emulgor A" and oleic acid [409]

Oil, cottonseed or corn, with sodium stearate or ammonium stearate [410]

Oil, cottonseed, corn, linseed, olive, rapeseed, peanut, sesame, castor or sperm, with soap [411]

Oil, cottonseed or mineral, or turpentine or benzene or carbon tetrachloride or chloroform or hexane, with gum acacia or soap [412]

Oil, cottonseed or other vegetable oil, with sulfonated coconut and castor oils [413]

Oil, cottonseed or red engine, with p-dichlorbenzol and sodium bicarbonate [414]

Oil, cottonseed, and tallow, with soap [415]

Oil, cranberry seed, with ursolic acid [416]

Oil, creosote, with gelatin [417]

Oil, creosote, with Nekal A.E.M. (glue and sodium isopropylnaphthalene sulfonate) [418]

Oil, creosote, with rosin soap [419]

Oil, creosote, with sodium hydroxide [420]

Oil, diesel, with bentonite [421]

Oil, dill weed, with gum tragacanth [422]

Oil, drying (e.g., linseed oil), with alkaline casein [423]

Oil, drying, with glue [424]

Oil, drying, with sodium hexametaphosphate [425]

Oil, drying, with triethanolamine soaps [426]

Oil, drying, and resins, or varnish, with sodium alginate [427]

Oil, egg yolk, with lecithin and cholesterol [428]

Oil, essential, with albumin and potassium bitartrate [429]

Oil, essential, with potassium oleate, triethanolamine linoleate or ammonium ricinoleate sulfate [430]

Oil, essential, with skim milk [431]

Oil, essential, with sugar solutions [432]

Oil, essential, with sulfonated fatty oil [433]

Oil, essential or etherial, or salol, with Turkey red oil sulfonaphthenic acids or purified sulfite cellulose liquor [434]

Oil, essential, and stearopten, with soft soap [435]

Oil, eucalyptus, with rosin soap [436]

Oil and fat, with albumin [437]

Oil or fat, with aluminum hydroxide and urea [438]

Oil or fat, with esters of sulfo-fatty acids and albumin or glue [439]

Oil or fat, with glycerin and starch [440]

Oil or fat and solvent and radioactive substance, with caustic soda [441]

Oil, fatty, with chlorhydrin or diethylene dioxide [442]

Oil or fatty acid, with soyabean phosphatides or lecithin [443]

Oil, fish, with casein and disodium phosphate [444]

Oil, fish, asphalt, petroleum, coal tar pitch, or cresol, with sulfite cellulose lye and colloidal silica [445]

Oil, fish or whale, with rosin soap [446]

Oil, flavoring, with gum acacia [447]

Oil, fuel, with clay or soap [448]

Oil, fuel, with starch or casein emulsion [449]

Oil, fuel, or coal, with nitrogen monoxide and casein or starch [449, 450]

Oil, fuel or kerosene, with alkali—or triethanolamine soap [451]

Oil, gas, with naphthenic soap [452]

Oil and glycol or glycol ether, with sulfonated oil [453]

Oil, hop extract, with malt syrup [454]

Oil, hydrogenated vegetable, with polymerized and oxidized glycerides [455]

Oil, linseed, with animal blood [456]

Oil, linseed, with antimony chloride [457]

Oil, linseed (boiled), with Duponol WA and caustic potash [458]

Oil, linseed, with egg albumin [459]

Oil, linseed, with glue and soda ash [460]

Oil, linseed, with potassium linoleate [461]

Oil, linseed, with sodium resinate and ammonium sulfate [462]

Oil, linseed, with sugar and starch [463]

Oil, linseed, butadiene and oleic acid, with Turkey red oil [464]

Oil, linseed, castor or soya bean, with ethanolamine oleate or hydroxyethylamine naphthenate [465]

Oil, linseed or castor, turpentine and cellulose acetate, with gelatin, glue and casein solution [466]

Oils, linseed and China wood, with casein, glue and flour [437]

Oil, linseed, China wood and gilsonite, with rosin soap [468]

Oil, linseed, and p-chlormetacresol, with potassium soap [469]

Oil, linseed, ester gum, and rosin, with triethanolamine [470]

Oils, linseed and mineral, with antimony chloride [471]

Oil, linseed, and oleic acid, with china clay, fuller's earth or bentonite [472]

Oil, linseed, poppy or soya bean with soap, saponin, sulfo-ricinates, carragheen moss or gelatin [473]

Oil, linseed, "Pyroxylin," butyl acetate and gasoline, with sodium oleate [474]

Oil, linseed, and rosin, with glue [475]

Oil, linseed, tallow and rosin, with sodium hydroxide [476]

Oil, lubricating (no added emulsifier)[477]

Oil, lubricating, with bentonite [478]

Oil, lubricating, with calcium oxide [479]

Oil, lubricating, with electric discharge [480]

Oil, lubricating, with kaolin, glue or skim-milk [481]

Oils, lubricating and pine, with sodium naphthenate [482]

Oil, marine, with disodium hydrogen phosphate [483]

Oil, mineral, with agar [484]

Oil, mineral, with agar and acid [485]

Oil, mineral, with agar; malt extract; casein or egg yolk; psyllium-seed, agar, and gelatin [486, 487, 488, 489, 490]

Oil, mineral, with alkali metal naphthenate and monethyl ether of ethylene glycol [491]

Oil, mineral, with alkali soap of sulfonated petreleo and glue [492]

Oil, mineral, with aluminum naphthenate and partially esterified glyceryl oleate [493]

Oil, mineral, with ammonium laurate [494]

Oil, mineral, with barium hydroxide [495]

Oil, mineral, with barium soap [496]

Oil, mineral, with basic copper sulfate, basic ferrous sulfate, basic nickel sulfate, ferrous hydroxide or ferric hydroxide [497]

Oil, mineral, with bentonite [498, 499]

Oil, mineral, with calcium stearate [500]

Oil, mineral, with cyclohexylamine oleate [501]

Oil, mineral, with diglycol laurate, diglycol oleate or sodium oleyl sulfate [502]

Oil, mineral, with dioctadecenyl ether of trioxytriethylamine-acetate [503]

Oil, mineral, with Fuller's earth [504]

Oil, mineral, with glue and sodium oil soluble mineral sulfonate [505]

Oil, mineral, with glyceryl monooleate or glyceryl naphthenate [506, 507]

Oil, mineral, with glycerylmonooleate and mahogany soap [508]

Oil, mineral, with gum acacia and tragacanth or agar [509]

Oil, mineral, with heptadecylamine hydrochloride and trisodium phosphate, sodium sulfate, palmitic acid, sodium tannate or 3N hydrochloric acid [510]

Oil, mineral, with lignosulfonic acid [511]

Oil, mineral, with lime water (calcium hydroxide sol'n.) [512]

Oil, mineral, with (skim) milk or diglycol laurate [513]

Oil, mineral, with monostearin and sodium stearate [514]

Oil, mineral, with montan wax [515]

Oil, mineral, with naphthalene sulfonic acid [516]

Oil, mineral with naphtylamine or quinol [517, 518]

Oil, mineral, with nonaethylene glycol dioleate [519]

Oil, mineral, with oxidized naphthenic hydrocarbons [520]

Oil, mineral, with petroleum sulfonates (water soluble) [521]

Oil, mineral, with phosphorized and sulfurized lard oil. Twitchell reagent and diethylene glycol [522]

Oil, mineral, with polyhydric alcohols partially esterified with higher fatty acids [523]

Oil, mineral, with polymerized oil ("Voltol"), wool fat or wool fat alcohols [524]

Oil, mineral, with saponified sulfonated oil soap [525]

Oil, mineral, with saponified sulfonated sperm oil [525]

Oil, mineral, with sodium cetyl sulfate, cholesterol, oleyl alcohol, elaidyl alcohol, cetyl alcohol, sodium stearate, sodium elaidate, sodium oleate, cetyl sulfate, cetyl sulfonate, sodium palmitate, cetyltrimethyl ammonium bromide, sodium taurocholate, sodium glycocholate or sodium desoxycholate [526]

Oil, mineral, with sodium oleate, arabic acid, sodium, magnesium or iron arabate, sodium or ammonium valerate, sodium galactonate, sodium dihydroxy stearate, sodium salicylate or sodium gallate [527]

Oil, mineral, with sodium oleate or haemoglobin [528]

Oil, mineral, with sodium oleate or Turkey red oil [529]

Oil, mineral, with sodium petroleum sulfonate and sodium rosinate [530]

Oil, mineral, with sodium salt of sulphated fish oil [531]

Oil, mineral, with sodium, and triethanolamine naphthenates [532]

Oil, mineral, with soya bean albumin and soda ash [533]

Oil, mineral, with starch, dextrin, and flour or gum senegal, or gum arabic with gum tragacanth or karaya [534]

Oil, mineral, with sulfonated castor oil or caustic alkali and olein, rosin or rosin oil, ammonia and alcohol [535]

Oil, mineral, with sulfonated castor oil, neutralized (Turkey red oil) [536]

Oil, mineral, with sulfonated fatty alcohol salt [537]

Oil, mineral, with triethanolamine sulfonate [538]

Oil, mineral and acetic acid (glacial), with "Emulgor A" and oleic acid [539]

Oil, mineral and aluminum chloride, with "Emulgor A" and oleic acid [540]

Oils, mineral and animal, with sulfurized unsaturated oil [541]

Oil, mineral, animal or vegetable, with lead salt of sulfated higher fatty alcohol [542]

Oil, mineral, benzene or olive oil, with sodium oleate, saponin or triethanolamine oleate [543]

Oil, mineral, butanol, with naphthenic soap [544]

Oil, mineral, and butanol, with sulfonated oleic acid sodium salt [545]

Oil, mineral, castor or olive, with saponin or sodium oleate, or gum tragacanth or sodium glycocholate or gum acacia [546]

Oil, mineral and citric acid, with "Emulgor A" and oleic acid [547]

Oil, mineral, creosote, with oil soluble mineral oil sulfonates [548]

Oil, mineral, and cresol, with fish oil soap [549]

Oil, mineral, and cresol, with sodium naphthenate [550]

Oil, mineral, decalin, olein cyclohexanol and turpentine, with soap [551]

Oil, mineral, and dinitro-o-cyclo-hexylphenol, with blood albumin [552]

Oil, mineral, fatty acid, carbon disulfide, turpentine or chlorinated hydrocarbons, with olein, soap and cyclohexanol [553]

Oil, mineral, fatty acids (vegetable or animal) and gas oil, with castor oil soap [554]

Oils, mineral and fish, with ammonium soap [555]

Oil, mineral and formic acid, with "Emulgor A", oleic acid and glaurin [556]

Oil, mineral, and hexalin, with mahogany sulfonates and gelatin [557]

Oil, mineral, and hydrocarbon gas, with bentonite [558]

Oil, mineral and hydrochloric acid, with "Emulgor A" and glaurin [559]

Oil, mustard or lemon, with gum acacia [560]

Oil, mineral or mustard, with pectin [561]

Oil, mineral, and naphthenic acid, with sulfonated naphthenic acid [562]

Oil, mineral, nicotine petroleum sulfonate, with soap [563]

Oil, mineral, and nicotine sulfate, with bentonite or diglycol oleate [564]

Oil, mineral, and oleic acid, with lime and soda ash [565]

Oil, mineral, and oleic acid, with sodium salts of petroleum sulfonates [566]

Oil, mineral, and oleic acid or naphthenic acid or alcohol rosin solution, with sodium petroleum sulfonates [567]

Oils, mineral and olive, with soap and sulfonated castor oil [568]

Oil, mineral, olive or castor, with sulfonated higher fatty alcohol [569]

Oil, mineral or olive, or oleine, with "Nekal A.E.M." [570]

Oil, mineral, or other hydrocarbons and alcohol, with nascent hydrogen [571]

Oil, mineral, and oxidized mineral oil, with potash soap [572]

Oil, mineral and oxyquinoline sulfate, with "Emulgor A" and oleic acid [573]

Oil, mineral, and phenol, with sodium resinate [574]

Oil, mineral and phosphoric acid, with "Emulgor A" oleic acid and glaurin [575]

Oils, mineral and pine, and turpentine, with calcium soap [576]

Oil, mineral, and rosin, with catechu or other tannin [577]

Oil, mineral and sodium chloride, with "Emulgor A" [578]

Oil, mineral and sulfuric acid (conc.), with "Emulgor A", oleic acid and glaurin [579]

Oils, mineral and tall, with alkali [580]

Oil, mineral or tar, with colloidal graphite, magnesium, oxide or carbonate [581]

Oil, mineral or tar, with glue and urea [582]

Oil, mineral or tar, with sulfite lye and caustic potash [583]

Oils, mineral and tar-acid, and isopropanol, with oil soluble petroleum sulfonate [584]

Oil, mineral and tartaric acid, with "Emulgor A" and oleic acid [585]

Oil, mineral and terpinyl acetate, with soap [586]

Oil, mineral, and turpentine, with antimony chloride [587]

Oils, mineral and vegetable, with soap and sulfonated oil [588]

Oil, neatsfoot, with aluminum hydroxide [589]

Oil, neatsfoot, with diethyloctylamine hydrochloride [590]

Oil, neatsfoot, with sulfonated cod oil and soap [591]

Oil, neatsfoot, with sulfonated neatsfoot oil and egg yolk or egg white [592]

Oils, neatsfoot and mineral, with sulfonated neatsfoot oil [593]

Oil, neatsfoot, train, bone, or rapeseed, with methyl cellulose [594]

Oil, olive, with ammonium oleate [595]

Oil, olive, with casein [596]

Oil, olive, with (alkaline) casein [597]

Oil, olive, with castor oil soap [598]

Oil, olive, with (skim) milk [599]

Oil, olive, with milk and egg yolk or starch [600]

Oil, olive, with oleyldiethylethylene diamine hydrochloride [601]

Oil, olive, with sodium oleate [602]

Oil, olive, and beef suet, with Irish moss [603]

Oil, olive or castor, with colloidal clay and alkali [604]

Oil, olive, castor, cedar or cod liver, with medicinal plant infusions, e.g., absinth or mint [605]

Oil, olive, castor, linseed or mineral, oleic acid, paraffin wax, higher alcohols, ketones or esters, with soap and glue, gelatin or gum arabic, in place of the soap, saponin or concentrated sulfite liquor can be used [606]

Oil, olive or cod liver, with sodium silicate [607]

Oil, olive, and paraffin wax, with glue [608]

Oil, olive, peanut, or cottonseed, with alkaline casein [609]

Oil, olive, peanut, cottonseed, or soya bean, lard, oleo or hy-

drogenated oils (castor, cod liver, or mineral oil), with raw egg, egg-white, egg yolk or dried egg [610, 611]

Oil, olive, peanut or other oils, with sulfonated oils, fats or fatty acids [612]

Oil, olive, sperm, castor, poppy or cod liver, with casein [613]

Oil, olive or sweet almond, with gum tragacanth or gum arabic [614]

Oil, olive, and tallow, with potassium carbonate [615]

Oil, oxidized drying, with sodium hydroxide or ammonia [616]

Oil, palm, with Duponol ME, cetyl alcohol and borax [617]

Oil, palm, with triethanolamine and tall oil [618]

Oils, palm and mineral, with soap [619]

Oil, palm and tallow or rapeseed oil, with sodium carbonate [620]

Oil, paraffin, with gelatin or Sapamine MS [621]

Oils, paraffin and fish, with soap and ammonia [622]

Oil, paraffin, benzene, nonyl alcohol or undecyl alcohol, with sodium oleate [623]

Oil, paraffin or cod liver, with "Tylose" (methyl cellulose) [624]

Oils, paraffin and linseed, turpentine and ether, with ammonia [625]

Oil, peanut, with ammonia [626]

Oil, peanut, with egg white and milk [627]

Oil, (hardened) peanut, with milk and egg yolk proteins [628]

Oil, peanut, with oleyl or cetyl adipate [629]

Oil, pine, with alkali and amine soap [630]

Oil, pine, with alkali soap and amine soap [630]

Oil, pine, with soya bean flour and soap [631]

Oil, pine and hydrochloric acid, with "Emulgor A" and oleic acid [632]

Oil, pine and sodium chloride, with "Emulgor A" [632]

Oil, pupa, with sodium oleate, gum arabic or dextrin [633]

Oil, rapeseed, with milk curds [634]

Oil, rapeseed, turpentine, oil of amber and camphor with soft soap and ammonia [635]

Oil or resin with glue or egg yolk [636]

Oil, sardine, with sulfonated naphthenic acid salt [637]

Oil, sesame, with polyglyceryl oleate [638]

Oil, shale, with lime [639]

Oil, shale distillate, with sulfite liquor, soap, glue, calcium caseinate or bentonite [640]

Oil, soya bean, with caustic and alum [641]

Oil, sperm, with glyceryl monostearate and sodium oleyl sulfonate [642]

Oil, sulfurized, with gelatin, casein, soap or saponin [643]

Oil, sulfurized colza, with saponin or soap [644]

Oil, tall, with soap and aniline [645]

Oil, tar, asphalt or rubber, with aromatic or hydroaromatic sulfonic acids or their alkali, calcium or magnesium salts [646]

Oil, tar, asphalt or rubber, with sodium petroleum sulfonates [647]

Oil, ti-tree, with cetyl alcohol [648]

Oil, train, neatsfoot, or mineral, or wool fat with methyl cellulose [649]

Oil, turpentine, with gelatin, water, glycerin, sucrose and tartaric acid [650]

Oil, vegetable, with ammonia and insecticide [651]

Oil, vegetable, with casein and alkali or amine [652]

Oil, vegetable, with egg yolk [653]

Oil, vegetable, with glycerylmono and distearates [654]

Oil, vegetable, with lecithin and alkali peroxide [655]

Oil, vegetable, with (skim) milk [656]

Oil, vegetable, with milk and partially oxidized soya bean oil [657]

Oil, vegetable, with polyhidric alcohol partially esterified with higher fatty acid [658]

Oil, vegetable, with sodium potassium or ammonium soaps [659]

Oil, vegetable, with starch and gum arabic or tragacanth [660]

Oil, vegetable, or fat, with pectin [661]

Oil, vegetable, or fatty acid, with vegetable phosphatides [662]

Oil, vegetable, fish or mineral, and boiled linseed oil, with maltose [663]

Oil, vitamin, concentrate, with gum arabic, pectin or agar [664]

Oil, volatile, creosote or thymol, with rosin soap [665]

Oil, waxes or resins, with ammonium linoleate [666]

Oleic acid, with ammonium oleate [667]

Oleic acid, with sodium oleate [668]

Oleic acid, with triethanolamine salt of oleyl sulfate [669]

Oleic acid, cyclohexanol, aniline or benzol, with ditolyl sodium phosphate [670]

Olein, with cetyl glucoside and Turkey-red oil [671]

Olein, with methyl cellulose and sulfated lauryl alcohol [672]

Paraffin wax, with calcium oleate [673]

Paraffin wax, with diethylamine oleate [674]

Paraffin wax, with (higher) fatty acid amide [675]

Paraffin wax, with gelatin [676]

Paraffin wax, with glue, alumina-gel, gelatin, soap [677, 678, 679, 680]

Paraffin wax, with gum ghatti [681]

Paraffin wax, with gum tragacanth [682]

Paraffin wax, with rubber latex [683]

Paraffin wax, with saponified montan wax [684]

Paraffin wax, with soap [685]

Paraffin wax, with sodium salt of petroleum sulfonic acid [686]

Paraffin wax, with sodium soaps of stearic, palmitic, ricinoleic or cerotic acid [687]

Paraffin wax, with soybean protein [688]

Paraffin wax, with sulfite cellulose extract and clay [689]

Paraffin wax, with trihydroxyethylamine stearate [690]

Paraffin wax and aluminum acetate, with "Emulgor A", oleic acid and glaurin [691]

Paraffin and beeswax and gum elemi, with sodium hydroxide [692]

Paraffin wax, beeswax, tallow, olive-oil or oleic acid with Lamepone A [693]

Paraffin wax and benzene, with soap [694]

Paraffin wax and benzol with alkali casein and rosin [695]

Paraffin wax, bitumen, oil or fat, with degraded starch [696]

Paraffin wax and carbon tetrachloride, with gelatin, glue or gum tragacanth [697]

Paraffin or ceresin wax, with soap and glue, albumin, casein, China clay or amines [698]

Paraffin, esparto, candelilla, wool, or montan wax and rosin with caustic soda [699]

Paraffin wax and esparto, wool or montan wax, with rosin soap [700]

Paraffin wax and linseed oil, with albumin [701]

Paraffin or montan wax, with corn oil soap and starch [702]

Paraffin wax and montan wax, with rosin soap and alkali [703]

Paraffin, montan, ceresin, spermaceti, or ozokerite wax, with

cetyl alcohol, wool fat alcohol, mono- or di-glycerides with or without soap [704]

Paraffin wax and oil, with alkali fatty acid soap and glue [705]

Paraffin wax or oil, with sodium dodecyl sulfate and lauryl pyridinium bisulfate [706]

Paraffin wax and phenol-formaldehyde resin, with sulfonated sperm oil and soap [707]

Paraffin wax or resins, with glue or starch [708]

Paraffin wax and rosin, with rosin soap [709]

Paraffin wax and shellac, with soap [710]

Paraffin wax and wool grease, with blood albumin [711]

Peat, with calcium oxide [712]

Petrolatum, with agar [713]

Petrolatum, with Turkey red oil [714]

Petrolatum, with wool wax [715]

Petrolatum and beeswax or stearic acid, with sodium salt of sulfonated hydrogenated castor oil or sulfonated castor oil [716]

Petrolatum and ceresin, with slaked lime [717]

Petrolatum or fat with phytosterols [718]

Petrolatum and tallow, with Turkey red oil soap [719]

Petroleum (cylinder), with calcium oxide [720]

Petroleum, with casein [721]

Petroleum, with ethanolamine dihydroxystearic acid [722]

Petroleum, with oil soluble sulphonated naphthenic acid [723]

Petroleum, with sodium petroleum sulfonate [724]

Petroleum, with sulfonated peanut oil and copper soap [725]

Petroleum, with sulfonated sodium salt [726]

Petroleum or coal tar pitch, with ammonium alginate [727]

Petroleum distillate, with condensation product of sulfonated oil and glycol or glycerol [728]

Petroleum, and moellon, with wool grease and soap [729]

Petroleum, pitch or bitumen, with sodium chloride or glycerol [730]

Petroleum residue, with starch [731]

Petroleum residue or gasoline, with sea water [732]

Petroleum, turpentine, chloroform, ethyl chloride ethyl bromide, ionone, terpineol, nitrobenzene aldehydes, pyridic or quinolic bases, tar, essential oils, bone oil, phenols, or naphthols, with sodium soap of castor oil [733]

Phenanthrene, retene, picene or chrysene, halogenated, with

soap, amine soap, gum arabic, starch, bentonite saponified montan wax or casein [734]

Phenol or cresol, with sodium sulfonates of shale tar [735]

Phenol and toluol, with sodium oleate [736]

Pitch, with bentonite [737]

Pitch, with chrome green [738]

Pitch, with soap and alkaline casein [739]

Pitch, with starch and tannic acid or quebracho [740]

Pitch, asphalt, resin or rubber, with bentonite [741]

Pitch, coal-tar, with ammonia [742]

Pitch, coal-tar, or asphalt, with clay [743]

Pitch, stearin and bitumen, with caustic soda or potash [744]

Pitch or tar, with sodium metasilicate [745]

Polyisobutylene and carbon tetrachloride, with sodium oleate and casein [746]

Polyvinyl compounds, with rosin soap [747]

Polyvinylisobutyl ether or polyvinylethylether, with ammonia and casein [748]

Pyrethrum extract, with sulfonated aromatic compounds [749]

Pyrethrum solution, with triethanolamine abietate [750]

Resin, with alkaline casein [751]

Resin, alkyd, with ammonia and casein [752]

Resin, alkyd, with ammonium diisopropyl naphthalene sulfonic acid [753]

Resin, alkyd, with casein and alkalies [754]

Resin, alkyd, with inorganic alkalies or organic bases [755]

Resins, alkyd and maleic with casein, ammonia and montan wax [756]

Resin, cellulose ester, with gum ghatti and sodium isopropylnaphthalene sulfonate [757]

Resin, cumarone, with sodium silicate [758]

Resin, cumarone, with triethanolamine and oleic acid [759]

Resin, cumarone-indene, with sodium silicate [760]

Resin, cumarone, and solvent, with Turkey red oil [761]

Resin, ethyl acrylate or styrene, with sodium isopropyl naphthalene sulfonate [762]

Resin, ethyl or benzyl cellulose, and solvent, with alkaline casein and sulfonated vegetable oil [763]

Resin "Glyptal" solvent and rubber, with bentonite and soap [764]

Resin, ethylcellulose, butyl acetate octyl acetate and toluol, with Deceresol O.T. (10%)[765]

Resin, methyl acrylate, with sodium isopropyl-naphthalene sulfonate or sulfonated castor oil[766, 767]

Resins, methyl-methacrylate and allyl-methacrylate, with coconut oil soap[768]

Resins, methyl-methacrylate, butyl-methacrylate, dammar and dibutyl-phthalate, with sodium decanolsulfate[769]

Resin, Neville, with triethanolamine oleate and trisodium phosphate[770]

Resin or oil with dry precipitated silicic acid[771]

Resin, paracumarone, with sodium silicate[772, 773]

Resin, phenol-formaldehyde, with ammonia casein and methylcyclohexanol stearate[774]

Resin, phenol-formaldehyde (partially reacted), with casein and alkali[775]

Resin, phenol-formaldehyde, with formaldehyde-phenol sulfonic acid[776]

Resin, phenol-formaldehyde, with gum ghatti or arabic[777]

Resin, phenol-formaldehyde, with sodium hydroxide and gum arabic[778]

Resin, phenol-formaldehyde, and benzene, with bentonite and sodium oleate[779]

Resin, polyvinyl acetate, with polyglycol laurate[780]

Resin, synthetic, e.g., tung oil and maleic anhydride resin, with ammonia, sulfonated oils, soaps or wool-fat acids and gum tragacanth or colloidal clay[781]

Resins or terpenes, with ammonium sulforicinoleate[782, 783]

Resin, thermoplastic, with soap[784]

Resin, urea-formaldehyde, with sulfated ricinoleic acid and naphthalene salts[785]

Resin, vinyl, with glue[786]

Resin, vinyl copolymer, and benzol, with Alkanol B[787]

Resin, vinyl, and toluene, with glue[788]

Rosin, with mono-, di-, or tri-hydroxyethylamine or hydroxyethyl alkylamines[789]

Rosin, with isobutylnaphthalenesulfonic acid[790]

Rosin, with rosin soap[791, 792]

Rosin, with soda ash[793]

Rosin, with soda ash, sodium bicarbonate and ammonia[794]

Rosin, with sodium caseinate [795]

Rosin, with sodium hydroxide [796]

Rosin, with sodium-, potassium-, or ammonium-, lauryl, cetyl, or octadecyl sulfate [797]

Rosin acids, with glue or gum arabic [798]

Rosin and benzine, with rosin soap [799]

Rosin, carbon tetrachloride, mineral oil, cresol, with rosin and caustic soda [800]

Rosin and essential oils, with rosin soap [801]

Rosin and lubricating oil, with alkaline casein [802]

Rosin and paraffin wax, with casein and starch [803]

Rosin and paraffin wax, mineral oil, tar oil, fatty oil, montan wax, turpentine, pine oil, butyl oleate or ethyl stearate with soap or alkaline casein [804]

Rosin and paraffin wax or turpentine, with casein and soap [805]

Rosin, rubber and cymene, with caustic soda [806]

Rosin and shellac, with caustic soda and soap [807]

Rosin, turpentine, and Japan wax, with borax and soap [808]

Rubber, with bentonite [809, 810]

Rubber, with calcium oleate [811]

Rubber, with casein [812]

Rubber, with colloidal clay [813]

Rubber, with glue [814]

Rubber, with glue, albumin, casein, gum arabic, sugars, gluten, starch, dextrin or colloidal clay and soap or saponin [815]

Rubber, with glue, casein or gluten [816]

Rubber, with glue, soap and alkali casein [817]

Rubber (vulcanized), with glue, soap or casein [818]

Rubber, with morpholine soap [819]

Rubber, with oilseed cake and hulls and alkali [820]

Rubber, with soap [821]

Rubber, with soap, colloidal clay, sea moss or albuminate or gelatinate [822]

Rubber, with soap, proteins, etc.[823]

Rubber, with sodium abietate, rosinate, oleate, palmitate or stearate [824]

Rubber, with sodium cetyl sulfate [825]

Rubber (plasticized), with sodium silicate [826]

Rubber, with sodium toluene sulfonate, potassium hydroxy-

naphthoate, potassium sulforicinoleate, potassium sulfanilate or sodium cholate [827]

Rubber, with sulfonated mineral oil [828]

Rubber, balata or gutta-percha, benzene and sulfur, with ammonium oleate [829]

Rubber and benzene, with soap [830]

Rubber and benzene, with soap and ammonium carbonate [831]

Rubber, benzene and kerosene, with sulfonated castor oil soap [832]

Rubber chloride solution, with dextrin, casein, starch or gum arabic [833]

Rubber, chlorinated, and carbon tetrachloride, with an alkali [834]

Rubber, chlorinated, cellulose esters or cellulose ethers and a solvent, with ammonium or potassium oleate [835]

Rubber, chlorinated, and trichlorethylene, with alkaline casein and Turkey-red oil [836]

Rubber and cumar or rosin, with whiting and rosin soap, locust-bean gum, starch or dextrin [837]

Rubber and cymene, with rosin soap [838]

Rubber, fluorinated, and solvent, with sodium stearate [839]

Rubber and gasoline, with ammonium sulforicinoleate [840]

Rubber (raw or vulcanized), gutta percha, balata or resins, with ammonium oleate [841]

Rubber and naphtha or benzol, with ammonium oleate [842]

Rubber and mineral oil, with casein and ammonia soap [843]

Rubber and oil, with metallic soap [844]

Rubber and oil, with sodium alkylnaphthalene sulfonate [845]

Rubber, reclaimed, with glue, soap, casein, gelatin or saponin [846]

Rubber, reclaimed, cumar and rosin oil, with sodium hydroxide [847]

Rubber, reclaimed, and spindle oil, with rosin soap or sulfonated castor oil [848]

Rubber and rosin, with alkali [849]

Rubber and solvent, with ammonia soap [850]

Rubber and solvent, with saponin [851]

Rubber, tar, rosin and solvent with alum and lime [852]

Rubber and turpentine, with glue and sodium carbonate [853]

Rubber and varnish with soap [854]

Sodium butadiene rubber with ammonia soap and casein [855]

Solvent (naphtha) with benzyl alcohol and butylnaphthalene sulfonic acid [856]

Solvents with carragheen kelp extract and oxalic acid [857]

Solvent, high boiling with bentonite and soap [858, 859, 860]

Solvent and phenol with tall oil and alkali [861]

Shale asphalt and montan wax with soap [862]

Shellac with protective colloids [863]

Soya protein and paraffin wax, with ammonium oleate [864]

Spermaceti, with borax and gum arabic [865]

Stearic acid, with ammonia, caustic potash, borax, triethanolamine, sulfonated oils, vegetable gums or glycol- or glyceryl stearates [866]

Stearic acid, with glue and sulfonated castor oil [867]

Stearic acid with sodium salt of naphthalene sulfonate [868]

Stearic acid, hydrogenated oils, waxes, mineral or fatty oils, with sulfonated higher fatty alcohols or hydrocarbons, e.g., lauryl alcohol sulfate [869]

Stearic acid or other higher fatty acid and paraffin oil or wax, with albumin or globulin [870]

Stearic acid, spermaceti and cetyl alcohol, with caustic soap [871]

Stearic anhydride, with deacetylated chitin [872]

Stearic anhydride, with soap [873]

Styrene, with ammonia soaps [874]

Styrene, with ammonium oleate or saponin, sulfonates or albuminoids [875, 876]

Styrene with soap or cetylpyridinium bromide [877]

Sulfur, with agar or carragheen [878]

Sulfur and asphalt, with sodium oleyl sulfate [879]

Sulfurized fatty oils, with tannic orgallic acid or tannins [880]

Sulfurized linseed oil, with tannin, gallic or tannic acid [880]

Tallow or beef fat and butter or vegetable oil, with skim milk [881]

Tallow and beeswax, with caustic potash [882]

Tallow and cresol, with soap [883]

Tar, with cumarone resin or rosin with soap [884]

Tar, with kaolin and borates, fluorides and chlorides [885]

Tar, with lime and aluminum salts [886]

Tar, with rosin soap and flour [887]

Tar, with saccharates of sodium, potassium, calcium, strontium or barium [888]

Tar, with soap and protein [889]

Tar, with sodium hydroxide [890]

Tar or asphalt, with soap and higher monohydric, aliphatic alcohol [891]

Tar or asphalt, with sodium petroleum (green) sulfonates [892]

Tar, asphalt or pitch, with metallic soap [893]

Tar or balsams, with egg yolk [894]

Tar or bitumen, with starch and soap [895]

Tar, coal, with polyvinyl chloride, soap, alkali protein or rosin soaps [896]

Tar, coal, with soap and tar [897]

Tar, coal, with soda ash and casein [898]

Tar, coal, with sodium oleate [899]

Tar, coal, with tincture of quillaja [900]

Tar, coal, and asphalt flux oil, with ammonium oleate [901]

Tar, coal or bitumen, with colloidal clay, sea-weed extract, soap, casein, starch, glue or gums [902]

Tar, coal, and mineral oils, mineral wax, naphthalene, or pitch, with alkali alginate [903]

Tar, coal, mineral, vegetable or animal oil with glue and rosin soap [904]

Tar, coal, and stearin pitch with caustic potash and casein [905]

Tar, coal or wood, with sulfonated lignin sodium salt [906]

Tar, creosote, bitumen, or petroleum with rosin soap and protein [907]

Tar and pepper oil with soap [908]

Tar or petroleum pitch with clay [909]

Tar, pitch or bitumen with rosin soap [910]

Tar, tar oil, petroleum or asphalt with brown coal [911]

Tar, wood, with algin [912]

Tar, wood, with soap and Irish moss [913]

Tar, wood or coal, or mineral oil residues with concentrated spruce sulfite liquor [914]

Terpene, maleic anhydride, polyhydric alcohol resin, with sodium hydroxide [915]

Terpineol, with sodium abeitene-sulfonate [916]

Tetrachlorethane, with laurylamine hydrochloride [917]

Tetrachlorethylene, with rosin soap and alkali casein [918]

Tetralin, with sodium oleate [919]

Thiuram and coconut oil, with casein [920]

Toluol, with sulfonated castor oil or sodium oleate streight [921]

Toluol and hydrochloric acid, with "Emulgor A" and oleic acid [922]

Toluol and sodium chloride, with "Emulgor A" and oleic acid [922]

Triazine (melamine) resins, with soap, or sulfated fatty alcohol [923]

Trichlorethylene with alcoholic sodium oleate [924]

Trichlorethylene with bentonite and Turkey red oil [925]

Triglycerides, with lecithin or polyhydroxy alcohols partially esterified with higher fatty acid [926]

Turpentine, with gelatin or egg albumin [927]

Turpentine, with pitch rosin soap [928]

Turpentine, with soap [929]

Turpentine, oil of thyme, oil of amber and petroleum, with soap and caustic potash [930]

Turpentine and pine oil, with oxgall [931]

Turpentine and suet, with soap [932]

Varnish, with ammonium soaps [933]

Varnish, with gum tragacanth [934]

Varnish, with mahogany petroleum sulfonates [935]

Varnish, with soap and glue [936]

Varnish, with soap or sulfonated oils [937]

Varnish (Japan), with sodium hydroxide [938]

Varnish, with soybean protein and ammonia [939]

Varnish, with saponified montan wax [940]

Varnish and solvents, with sodium stearate [941]

Varnish (Japan), or asphalt with soap or alkali casein [942]

Vinyl acetate, with methyl cellulose or ethers or acetals of polyvinyl alcohol [943]

Vinyl acetate, with sulfonated castor oil [944]

Vistanex polybutene and solvents, with soap, casein or gums [945]

Vitamins (oil soluble), with fatty acid ethers or esters of polyhydroxy alcohols [946]

Vitamin A and D concentrates, with morpholine oleate, ricinoleate or linoleate [947]

Vitamin D concentrate, with polyglyceryl partial fatty acid ester, lecithin or glyceryl monolaurate [948]

Vitamin containing vegetable oils, with agar or Irish moss or egg yolk [949]

Vitamins, or irradiated ergosterol and vegetable oil, with gelatin, agar, carragheen, egg yolk, casein, gum arabic or tragacanth [950]

Wax, with cetylmethylpiperidinium methylsulfate [951]

Wax, with soap [952]

Wax, hydrocarbon, with oil soluble petroleum sulfonic acid soap [953]

Wax, hydrocarbon, or oils, with alkylated naphthalene sulfonic acid or salt [954]

Wax or rosin and coal oil, with bentonite [955]

Wax, vegetable, with caustic potash [956]

Wool fat, with methyl cellulose [957]

Wool fat and varnish resin, with ammonia soap [958]

Wool grease, with blood albumin [959]

Wool grease, with cyclohexanol [960]

Xylene, with sodium oleate and phenol [961]

Xylene and phenol, with sodium oleate [962]

Xylene or sulfonated xylene, with Turkey red oil or soap or sulfated higher alcohol salts [963]

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CHAPTER IX

LIST OF DEMULSIFYING AND DEFOAMING AGENTS

Acetylated hydroxy higher fatty acid is used for demulsifying petroleum.[1]

Acetylsulforicinoleic acid is used as a demulsifier.[2]

Acylated amino ether is used as a demulsifier.[3]

Ammonium sulfide is a demulsifier.[4]

Amylated aromatics are used as demulsifiers.[5]

Break the petroleum emulsion, by passing under pressure through cloth or filter earth.[6]

Calcium acetate with monohydric or dihydric alcohol is used as a defoamer.[7]

Combined magnetic and electric fields are used for demulsifying.[8]

Condensation product of sulfonated aniline and aliphatic alcohol or aldehyde acts as demulsifier.[9]

Degras is dispersed under pressure into fermentation tank to break Brewer's foam.[10]

Electrical breaking of emulsion is accomplished by passing between high tension electrodes.[11, 12, 13, 14, 15, 16, 17, 18, 19, 20]

Electrical and mechanical baffle effects are used for demulsifying petroleum.[21]

Esters of blown fatty oils are used for breaking petroleum emulsions.[22]

Ester of polybasic carboxylic acid and an acylated amino ether are used as demulsifiers.[23]

Glyceryl monoricinoleate is used for demulsifying petroleum.[24]

Gravity flow is used to break crude oil emulsions.[25]

Halogenated sulfonated fatty acid or ester is used for demulsifying petroleum.[26]

Heating with SO_2 and H_2S breaks emulsions.[27]

Heat petroleum emulsions and pass them under pressure through infusorial earth, filter cloth and fine metal screen.[28]

Heat and vacuum are used to break foam.[29]

Intermittent direct current is superimposed on the applied alternating current at intervals of several seconds for breaking petroleum emulsions.[30]

Inversion of W-O emulsions, by reagents, e.g., by oxidized hydrocarbons, often breaks emulsions.[31]

Isoamyl valerate is a defoamer.[32]

Isopropanal and tributyl phosphate are used as a defoamer.[33]

Kerosene emulsions are broken by carbon black.[34]

Laurylamine hydrochloride is a defoamer.[35]

Lignin sulfonate and propylnaphthalene sulfonic acid are demulsifiers.[36]

Lower fatty acid esters of hexyl, heptyl or octyl alcohols are foam inhibitors.[37]

Microbes and sustaining medium break emulsions.[38]

Passing between moving gears of different wettabilities is used for breaking emulsions.[39]

Passing through capillary media, e.g., cloth is used for demulsifying.[39a]

Passing through zeolites and iron sulfide and quartz breaks emulsions.[40, 40a]

Phosphatide (lecithin) is a foam reducer.[41]

Reaction product of abietine, aldehyde and sulfonating agent are used for breaking emulsions.[42]

Reaction product of blown fatty oil with aldehyde reactive agent, used for demulsifying petroleum.[43]

Reaction products of sulfonated cottonseed oil with chlorinated cyclopentane are used to break mineral oil emulsions.[44]

Sodium chloride and magnesium oxide or "Tret-o-Lite" (patented mixture of soap, sodium silicate, phenol, paraffin and water.); ether and carbon bisulfide are used for breaking emulsions.[45, 46]

Sodium sulfobenzyl phthaloricinoleate is a demulsifier.[47]

Solid aliphatic alcohol and liquid aliphatic alcohol of at least 8 carbon atoms, used as a defoamer.[48]

Sugars break certain oil emulsions by dehydration at the interface.[49]

Sulfated cetyl alcohol is a demulsifier.[50]

Sulfonated fatty glyceride and calcium chloride are used in breaking emulsions.[51]

Sulfated lauryl alcohol is used for breaking emulsions.[52]

Sulfonated mixture of rosin oil and castor oil, used for demulsifying petroleum.[53]

Tar oil emulsions containing sodium phenolate are resolved by allowing to stand.[54]

Violet, ultra-violet light, X-ray etc. are used for breaking emulsions.[55, 56, 56a]

Water insoluble basic alkyl salt of petroleum sulfonic acid is used for breaking petroleum emulsions.[57, 58]

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PART II

FORMULAS

CHAPTER I

AGRICULTURAL SPRAY EMULSIONS

Formula No. 1.

Mineral Oil	2–2½ gal.	Trihydroxyethylamine Linoleate	½–1 lb.
Diglycol Oleate	2–3 oz.	Water	100 gal.

Add in the above order and beat vigorously. The above emulsion is quick breaking and spreads easily.[1]

Formula No. 2.

A petroleum fraction having a sulphonation value above 50, 1.2–0.3 per cent, trichlorobenzene 0.4–0.1 per cent, an emulsifying agent 0.04–0.01 per cent, water 98.36–99.59 per cent.[2]

Formula No. 3.

Mineral Oil (60–80 sec.)	95.95	Beta Naphthol	0.05
Aluminum Oleate	2.50	Water[3]	To suit
Glyceryl Monooleate	1.50		

Formula No. 4.

Anthracene Oil	75	Water[4]	22
Fish Oil Soap	3		

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[1] Bennett, Chem. Formulary, Vol. 1, p. 215 (1933).
[2] U. S. 2,046,901.
[3] Sharp, U. S. 2,240,806 (1941).
[4] Bennett, Chem. Formulary, Vol. 1, p. 215 (1933).

FORMULA No. 5.

Diglycol Laurate	5 qt.	(20 Fold)	¾ p
Pyrethrum Extract		Water[5]	100 gal.

FORMULA No. 6.

Derris Extract (5%)	1 qt.	Water[6]	100 gal.
Skim Milk Powder	1 lb.		

FORMULA No. 7.

Mineral Oil	93	Nicotine Oleate
Glyceryl Oleate	2	

0.84 pounds of casein is slowly poured into about 2 gallons of cold water, and stirred until thoroughly wet and soaked, then 0.63 pounds of dehydrated sodium carbonate is added, stirring until all the casein is well in solution. Six gallons of denatured alcohol is then added, and 1.67 pounds of powdered gamboge. The gamboge is added slowly with constant stirring. Enough water is then added to make up a total of 20 gallons. With this composition, the oil to be emulsified is incorporated, preferably by slow additions, with agitation. Most oils emulsify therein readily. Heat may be applied if quicker emulsification is desired. For petroleum oil for example, with a specific gravity of 0.891 a proportion of 1 part by volume of the foregoing composition to 5 parts of the oil affords a satisfactory product. Such emulsion will contain about 83.3% of oil, making up to a consistency about that of lard at the same temperature. Such a product even after standing in a warm place for months is free from separation.[7]

FORMULA No. 8.

Mineral Oil	91.4	Nicotine	2.0
Glyceryl Oleate	1.5	Napthenic Acid	3.1
Aluminum Oleate	2.0	Add water before use.	

[5] *Ibid.*, Vol. 3, p. 119 (1936).
[6] *Ibid.*
[7] Bennett, Chem. Formulary, Vol. 1, p. 216 (1933).

Nicotine, commercial (95%), 5 fl. oz.; soft soap, commercial, 2½ lb.; alcohol (95%), 80 fl. oz. For use, dilute with 160 volumes of water. A mildew spray is: Linseed oil, 12 fl. oz.; liver of sulphur, 2 lb.; cresol, 3 lb.; caustic potash, commercial, 1 lb.; water to make 1 gallon.[8]

FORMULA No. 9.

Olein	20 kg.	Caustic Potash (24° Bé.)[9]	19 kg.
Coal Tar Oil	70 kg.		

FORMULA No. 10.

Talloil, Crude	22 kg.	Caustic Soda (36° Bé.)[10]	9 kg.
Coal Tar Oil	70 kg.		

FORMULA No. 11.

Talloil—Distillate	22 kg.	Caustic Potash	
Coal Tar Oil	68 kg.	(36° Be.)[11]	12.5 kg.

FORMULA No. 12.

Woolfat Fatty Acid, Crude	25 kg.	Caustic Potash (36° Bé)[12]	12 kg.
Coal Tar Oil	65 kg.		

FORMULA No. 13.

Olein	20 kg.	Caustic Soda (36° Bé.)	9 kg.
Coal Tar Oil	65 kg.	Methyl Hexalin[13]	5 kg.

FORMULA No. 14.

Talloil, Crude	20 kg.	Caustic Soda (24° Bé.)	15 kg.
Coal Tar Oil	62 kg.	Alcohol, Denatured[14]	3 kg.

FORMULA No. 15.

Olein	5 kg.	Coal Tar Oil	70 kg.
Colophony	15 kg.	Caustic Soda (36° Bé.)[15]	9 kg.

[8] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[9] *Ibid.*, p. 75 (1941).
[10] *Ibid.*
[11] *Ibid.*
[12] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[13] Ibid.
[14] Ibid.
[15] Ibid.

FORMULA No. 16.

Talloil, Crude	10 kg.	Coal Tar Oil	65 kg.
Colophony	10 kg.	Caustic Soda (24° Bé.)[16]	15 kg.

FORMULA No. 17.

Talloil, Crude	15 kg.	Coal Tar Oil	70 kg.
Woolfat Fatty Acid	10 kg.	Caustic Soda (24° Bé.)[17]	11.5 kg.

FORMULA No. 18.

Talloil, Crude	10 kg.	Coal Tar Oil	70 kg.
Woolfat Fatty Acid	10 kg.	Caustic Soda (36° Bé.)[18]	8 kg.

FORMULA No. 19.

Colophony	20 kg.	Coal Tar Oil	60 kg.
Crude Montan Wax	5 kg.	Caustic Potash (40° Bé.)[19]	12 kg.

Preparation:

Use iron or enamelled agitated kettles which are steam-heated, or fired from below, and that can be emptied at the bottom.

Heat 50% of the coal tar oils (or their blends) with the saponifiable materials (colophony, olein, talloil, montan wax, woolfat fatty acid, etc.) to about 80°C.

Thin the saponification lye with 50-100% of water in a separate kettle, low-degree-lyes being more diluted than high-degree lyes.

The thinned caustics are stirred into the hot oils. Boil. The saponification starts when the content of the kettle starts "rising."

Stir continuously, watch the heating in order to prevent the kettle boiling over.

As soon as the saponification is done, add the remainder of the coal tar oil, which is to be heated separately to 70°C. before.

[16] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[17] Ibid.
[18] Ibid.
[19] Ibid.

When all is well mixed, boil for a second time, until the material is (nearly) clear. Too much water in the preparation makes it cloudy. In such a case boil further.

Test by cooling a sample, which should be clear and show the right, well-bound consistency. If the cooled sample is gelatinous, water should be added.[20]

FORMULA No. 20.

Coal Tar Oil (Carbolineum)	60 lb.	Ammonia (sp.g. 0.96)	15 lb.
Talloil	25 lb.	Water	10 lb.

Saponify at about 40-50°C. Should emulsify readily with 10 times the amount of water.[21]

FORMULA No. 21.

Talloil	300 kg.	Tar Oil (Middle Fraction)	1,200 kg.
Caustic Soda (20°Be.)	280-290 kg.	Crude Mineral Oil[22]	200 kg.

FORMULA No. 22.

Nicotine Sulphate (40%)	1 pt.	Sodium Lauryl Sulphate	½ oz.
Bentonite	5 lb.	Water[23]	100 gal.
Soybean Oil	1 qt.		

FORMULA No. 23.

Cottonseed Oil	6 pt.	Hydrated Lime	6 lb.
Copper Sulphate (10% solution)	4½ gal.	Water[24]	100 gal.

FORMULA No. 24.

Nicotine	¾ oz.	Water[25]	10 gal.
Soft Soap	½ lb.		

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[20] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[21] Ibid.
[22] Ibid.
[23] Ibid.
[24] Bennett, Chem. Formulary, Vol. 5, pp. 75-76 (1941).
[25] Ibid.

FORMULA No. 25.

Caustic Soda	1.3 lb.	Mineral Oil	50-72 lbs.
Napthenic Acids	10-12 lbs.		

Dilute and mix with water as needed.[2]

FORMULA No. 26.

Soft Soap	33 lb.	Potassium Permanganate (½ normal)	22 lb.
Cresol Soap (2% solution)	11 lb.	Vegetable Glue	17 lb.
Tobacco Extract (10%)	17 lb.	Alcohol	¼-2 lb.

FORMULA No. 27.

Copal Oil	500 lb.	Morpholine	20 lb.
Water	2000 lb.	Oleic Acid	45 lb.

Add the oleic acid to the copal oil, using stirring. Then add the morpholine, still using high speed stirring. Add the water slowly and keep up stirring during addition of water.

This copal emulsion when sprayed on Japanese beetles will prevent them from flying and kill them slowly.[27]

FORMULA No. 28.

Phenothiazine	3 lb.	Water[28]	100 gal
Soap	½ lb.		

FORMULA No. 29.

Derris (4% Rotenone)	3 lb.	Water[29]	100 gal
Sodium Lauryl Sulphonate	3 oz.		

Spray twice ten days apart.

FORMULA No. 30.

Arachis Oil	2.00 1.	Ammonia	0.50 1
Oleic Acid	0.75 1.	Water	100.00 1

J. S. 2,000, 843.

[27] Bennett, Chem. Formulary, Vol. 5, p. 101 (1941).

[28] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).

[29] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).

The oil is mixed with the oleic acid. The ammonia is added to 2 l. of water. The oil mixture is added to the ammonia solution slowly with high speed agitation.[30]

FORMULA No. 31.

Cottonseed Oil	1 gal.	Potash Fish-Oil Soap	1 pt.
Paradichlorobenzene	2 lb.	Water to make	2 gal.

Dissolve 2 pounds of paradichlorobenzene crystals in 1 gallon of cottonseed oil. To do this, in cool weather, heat the oil to about 90°F., before adding the chemical. Stir the oil until the crystals entirely dissolve before proceeding further. Stir the resultant mixture into 1 pint of potash fish-oil soap and then stir in enough water to make 2 gallons. This stock emulsion may be stored for several days in a sealed drum. Each gallon of the stock emulsion should be diluted with 3 gallons of water immediately before making the treatment.[31]

FORMULA No. 32.

A 5% petroleum emulsion (made by adding 5.1 petroleum to 1 kg. laundry soap dissolved in 10 l. boiling water) is recommended against thrips.[32]

FORMULA No. 33.

Pyrethrum Extract	1 qt.	Neutral Soap	4 lb.
Kerosene	6 gal.	Water [33]	94 gal.

FORMULA No. 34.

White Mineral Oil (Vis. 80-85)	85 oz.	Triamylamine	3 oz.
		Monomylamine Oleate	10 oz.

One oz. of above mixture is diluted with 200-400 oz. of water.[34]

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[30] Bennett, Chem. Formulary, Vol. 5, p. 102 (1941).
[31] Bennett, Chem. Formulary, Vol. 5, p. 90-91 (1941).
[32] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[33] Bennett, Chem. Formulary, Vol. 3, p. 119 (1936).
[34] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).

FORMULA No. 35.

Glyceryl Oleate	2	White Mineral Oil[35]	93
Oil Soluble Nicotine Compound	5	Water, to suit	

FORMULA No. 36.

Glyceryl Oleate	1.5	Naphthenic Acid	3.1
Aluminum Oleate	2.0	White Mineral Oil[36]	91.4
Nicotine	2.0	Water To suit	

FORMULA No. 37.

Gum Ghatti	2.4 lb.	White Oil (80 sec. Saybolt at 100°F.)	62.4 lb.
Cresylic Acid	0.18 lb.	1,4-Toluido Anthraquinone	0.02 lb.
Water	35 lb.		

The concentrated emulsion may be prepared by intimately mixing the ingredients in a colloid mill or by passing the mixture through a centrifugal pump or in any other suitable manner to give a concentrated emulsifiable composition which may readily be diluted to yield an emulsion suitable for spraying purposes.[37]

FORMULA No. 38.

Nicotine Sulphate (40%)	1 pt.	Wetting Agent ("Wetanol")	½ oz.
Bentonite	5 lb.		
Soybean Oil	1 qt.	Water	100 gal.

Mix well until emulsified.[38]

FORMULA No. 39.

Diglycol Oleate	2 lb.	Pyrethrum Extract (Mineral Oil or Kerosene)	50 lb.

Mixing the above together gives a concentrated spray base free from alkalies. The active principle of pyrethreum is thus unaffected. Burning due to alkali is also eliminated.

The above concentrate emulsifies readily on stirring in

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[35] Adams, U. S. 2,258,833 (1941).
[36] Adams, U. S. 2,258,833 (1941).
[37] Bennett, Chem. Formulary, Vol. 3, p. 119 (1936).
[38] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).

water with a pump. It is "quick-breaking" when sprayed on the foliage.[39]

In any of the following formulae, which does not include water, such a formula is an emulsion base. These bases form emulsions on mixing with water.

FORMULA No. 40.

Mineral oil 82.5, oleic acid 8.5, phenol 1.0, isoamyl alcohol 3.0, ethylene glycol monoethyl ether 1.5, caustic potash, 50% solution, 3.5. The formula for the emulsifier alone, which can be added to various insecticide liquids as required, contains; oleic acid 48.6, phenol 5.7, isoamyl alcohol 17.1, ethylene glycol monoethyl ether 8.6, caustic potash, 50% solution, 20. Amyl alcohol can be substituted for isoamyl alcohol, but the emulsifier is somewhat less stable; substitution of pine distillates requires special precautions. An emulsifier for miscible mixtures is oleic acid 32.5, cresol U.S.P. 32.5 "Yarmor" pine oil 10.0, caustic potash, 50% solution, 15.0 and kerosene 10.0. Fifteen percent of this emulsifier forms a miscible mixture which is stable on dilution with water. Phenol cannot be substituted for cresol in this formula. A combined spreader and emulsifier contains: oleic acid (high sapon. no.) 25.0, cresol U.S.P. 15.0, caustic potash, 50% solution, 20.0, kerosene 5.0. It has high emulsifying and spreading powers. In some instances α terpineol can be substituted for yarmor pine oil, and London resin and pine tar oil (sp. gr. 1.035) for cresol. The formulas may be used with many but not all insecticide liquids; modifications are sometimes necessary.[40]

FORMULA No. 41.

Petroleum Oil (40-100 Sec. Saybolt)	100 lb.	Cetyl Alcohol[41]	0.2-10 lb.

[39] Ibid., Vol. 1, p. 215 (1933).
[40] Bennett, Chem. Formulary, Vol. 5, pp. 76–77 (1941).
[41] Bennett, Chem. Formulary, Vol. 4, p. 105 (1939).

FORMULA No. 42.

Pyrethrum Extract, 15%	100 kg.	Turkey Red Oil, Neutral	500 kg.

Apply in 0.5–1% aqueous dilution.[42]

FORMULA No. 43.

Pyrethrum Extract, 15% in acetone	100 kg.	Derris Extract in Acetone, (8% Rotenone)	100 kg.
Turkey Red Oil, Neutral[43]	800 kg.		

FORMULA No. 44.

Pyrethrum Extract (Kerosene)	1 gal.	Carbon Tetrachloride[44]	4 gal.

FORMULA No. 45.

1 gram of pure rotenone is dissolved in 100 cc. pyridine. 1 cc. of this solution is added to 100 cc. distilled water and shaken gently. A pale opalescent colloidal solution results which shows no evidence of separation over an extended period of time.[45]

FORMULA No. 46.

5 grams of pure rotenone is dissolved in 100 cc. pyridine. 1 cc. of this solution is added to 100 cc. distilled water and shaken gently. A deeply opalescent colloidal solution results which shows no evidence of separation over an extended period of time.[46]

FORMULA No. 47.

1.2 grams of pure rotenone is dissolved in 100 cc. a-picoline. 1 cc. of this solution is added to 100 cc. distilled water and shaken gently. A colloidal solution of medium opalescence

[42] Ibid., p. 107 (1939).
[43] Ibid.
[44] Ibid., p. 104 (1939).
[45] Ibid., Vol. 2, p. 272 (1935).
[46] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).

results which shows no evidence of separation during a considerable period of time.[47]

FORMULA No. 48.

Water	5 cc.	"Cellosolve"	10 cc.
Caustic Potash	7.4 g.	Oleic Acid	33.3 cc.
Pine Tar Oil	44.3 cc.		

Mix in the order given.[4]

FORMULA No. 49.

Water	5.00	Ethylene Glycol Monoethyl Ether	10.00
Potassium Hydroxide (92% Flaked)	7.40	Oleic Acid[49]	33.30
Pine Tar Oil (Sp. Gr. 1.035)	44.30		

Mix in the order given.

FORMULA No. 50.

Soap	8 oz.	Water	1 gal.

Boil and while mixing vigorously, add slowly

Pine Tar oil (d. 1.065)[50]	6 oz.

FORMULA No. 51.

Kerosene	90 g.	Triethanolamine	g
Oleic Acid	8 g.	Water[51]	100 g.

This is made into a primary emulsion and may be diluted with one or two gallons of water for washing infested animals.

FORMULA No. 52.

Naphthalene	1 oz.	Cyclohexanol	2 oz.
Kerosene	4 oz.	Creosate[52]	1 oz.

47 Ibid.
48 Ibid., Vol. 3, p. 118 (1936).
49 Ibid., Vol. 4, p. 105 (1939).
50 P. C.
51 Ibid., p. 115 (1939).
52 Ibid., p. 104 (1939).

Dissolve by mixing and add slowly with vigorous stirring

Liquid Soap	32 oz.	Water	120 oz.

FORMULA No. 53.

Phenol	1 lb.	Water [53]	3 gal.
Fish Oil Soap	1 lb.		

Emulsify by stirring vigorously.

Fruit Protective Emulsions

FRUIT COATING WAX

FORMULA No. 1.

Caustic Soda	6	Carnauba Wax	55
Triethanolamine	20	Shellac	100
Stearic Acid	42	Water	2000
Paraffin Wax	165		

Dilute above before use.[1]

FORMULA No. 2.

Paraffin Wax	553	Triethanolamine	98
Carnauba Wax	68	Water (Containing soda ash)[2]	To suit
Cottonseed Oil	98		
Oleic Acid	183		

FORMULA No. 3.

Paraffin Wax	168.0	Sodium Bicarbonate	6.6
Beeswax	42.0	Salt	2.2
Oleic Acid	22.0	Water [2a]	599.2

It is necessary that the soap be formed simultaneously with the first stage of emulsification by the addition of the alkali, in a minimum amount of water, to a mixture of the fatty acid and molten wax. These emulsions will readily coat fruits and vegetables with nonwaxy surfaces; but spreading agents

[53] Ibid., p. 109 (1939).
[1] U. S. 2,153,487.
[2] MacRill, U. S. 2,019,758 (1935).
[2a] Trout, J. Coun. Sci. Ind. Research *15*, 26 (1942).

are necessary when they are used for waxy fruits. Alkyl naphthalenesulfonates are suitable spreading agents and also inhibit breaking of the emulsions.

SHEEP DIPS

Formula No. 1.

Hydrocarbons	46.78 g.	Rosin	5.39 g.
Pyridin	2.36 g.	Soap	18.10 g.
Cresylic Acid	21.67 g.	Water [3]	5.70 g.

Formula No. 2.

Tar Oil	39.30 g.	Crude Cresylic Acid	3.70 g.
Paraffin Oil	31.00 g.	Soft Soap [4]	21.00 g.
Lanclin	5.00 g.		

The tar oil used is that oil coming over between 180° to 220°C. and containing 20.25 per cent phenol. All the materials are mixed together in a boiler, and gradually heated until all the soap and lanolin have quite dissolved and then boiled gently for a short time, cooled and packaged, and is

Formula No. 3.

Tar Oil	41.80 g.	Crude Cresylic Acid	3.70 g.
Paraffin Oil	33.50 g.	Soft Soap	21.00 g.

made in the same manner as the previous dip.[5]

[3] Bennett, Chem. Formulary, Vol. 5, p. 112 (1941).
[4] Ibid., p. 113 (1941).
[5] Ibid.

CHAPTER II

CUTTING OILS, SOLUBLE OILS, MISCIBLE OILS

Formula No. 1.

Sodium Corn Oil Soap	14	Water White Rosin	10
Water	6	"Carbitol"	2
Mineral Oil	64	Diethylene Glycol	4

This oil is clear and will not become cloudy when cooled to a temperature of 60°F. It will not become covered with a film after standing exposed to the air at a temperature of 80°F. over a long period of time or at a temperature of 200°F. for one day. This oil will readily emulsify with water after standing exposed to the air at 200°F. for two days. Aqueous emulsions containing this oil are very stable even at a temperature of 200°F. In general, stable aqueous emulsions are prepared by using 1% to 35% of this oil, although stable aqueous emulsions can be prepared by using proportions of the oil outside these limits.[1]

Formula No. 2.

Kerosene	60 g.	Sulfonated Coconut Oil (Neutralized with Rosin Soap)	20 g.
Sulfonated Castor Oil	20 g.		
Alcohol	1 g.		

This forms an emulsion when mixed with water.[2]

[1] U. S., 1,965,935.
[2] U. S., 2,021,448.

FORMULA No. 3.

a. Oleic Acid	15	b. Kerosene	10
Rosin	15	c. Trigamine	20

Melt at 85°C. with high speed stirring. Add c and continue stirring. Then turn off the heat and add b slowly with stirring. This gives a clear transparent liquid which emulsifies readily in water.[3]

FORMULA No. 4.

Mineral Oil	Glycostearin
Aerosol OT (100%)	

Heat together to 100–120°C. cool to 80°C. and then add slowly with stirring to water (100 parts) (heated to 80°C.)[4]

FORMULA No. 5.

Rosin	15	Isopropyl Alcohol	10
Red Oil	15	"Wetanol" or other Wetting Out Agent	1/16
Mineral Oil	10		
Potassium Hydroxide (45%)	5		

Warm together and mix until uniform.[5]

FORMULA No. 6.

a. Mineral Oil (Spindle Oil)	80	b. Caustic Potash (40° Bé)	6
Tall-Oil, Refined	20	c. Methylhexalin[6]	1–2

Saponify a with b, clear with c.

FORMULA No. 7.

Mineral Oil	71–74	Caustic Potash	8¼–9½
Castor Oil	8¼–9½	Soda Ash	0.6–1¼
Rapeseed Oil	8¼–9½		

Mix and dilute with water.[7]

[3] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[4] P. C.
[5] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[6] Ibid., Vol. 3, p. 210 (1936).
[7] Bennett, Chem. Formulary, Vol. 3, p. 210 (1936).

FORMULA No. 8.

Mineral Oil	75	Naphthenic Acid Sludge[8]	25

FORMULA No. 9.

Mineral Oil	75	Naphthenic Soap[9]	25

FORMULA No. 10.

Mineral Oil	32	Alcohol
Oleic Acid	10	Trigamine

The above are thoroughly mixed cold and form a clear transparent oil which readily emulsifies on pouring into water with slight stirring.[10]

FORMULA No. 11.

Light Mineral Oil	65	Water	5
Sulphonated Cod Oil	27	Caustic Soda	2
Olein	10	Cresol[11]	1

FORMULA No. 12.

Alcohol, Denatured	15	Mineral Oil[12]	400
Diglycol Laurate	85		

FORMULA No. 13.

Pine Oil	75	Water	20
"Carbitol"	25	Diglycol Laurate	360
"Sulfatate" (or other water-soluble sulphonic acid-esters or salts)	20	Mineral Oil	1600

The "sulfatate" is dissolved in water and mixed well into the other ingredients. This oil disperses in hard waters without scum formation.[13]

FORMULA No. 13A.

Sulphonated Castor Oil	15	Diglycol Laurate	80
"Carbitol"	5	Mineral Oil[14]	410

[8] Ibid., Vol. 4, p. 187 (1939).
[9] Ibid.
[10] Ibid.
[11] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[12] Ibid., p. 187 (1939).
[13] Ibid., p. 95 (1939).
[14] Ibid.

FORMULA No. 14.

(1) Sodium Abietate	10	(3) Mineral (Paraffin) Oil[14a]	40
(2) Pine Oil	10		

Mix (1) and (2) and then add (3).

FORMULA No. 15.

(1) Sodium Abietate	31	(3) Denatured Alcohol	4
(2) Rosin Oil	10	(4) Mineral (Paraffin) Oil[15]	159

The above oils give rich creamy emulsions with water.

FORMULA No. 16.

Oleic Acid	10	Trigamine	5
Mineral Oil	32	Alcohol[16]	3

FORMULA No. 17.

Rosin	20	Diethylene Glycol	20
"Petronate"	100	Mineral Oil[17]	840

FORMULA No. 18.

Olein or Wool Grease	12.25	Mineral Oil	2.45
Animal or Vegetable Oil	7.50	Caustic Soda Solution[18]	77.80

FORMULA No. 19.

Paraffin Oil	48 fl. oz.	Red Oil	15 fl. oz.
Water	34 fl. oz.	Sodium Hydroxide[18a]	1.8 oz.

The sodium hydroxide, carefully weighed, is dissolved in the water and the red oil and paraffin oil which have been previously mixed are run in while stirring rapidly. This forms a white milky preparation.

FORMULA No. 20.

Paraffin Oil (28° Bé.)	33	Sulphonated Red Oil (75%)	33
Sulfonated Castor Oil (75%)	33	Manipulation; Mix at 40°C.[19]	

[14a] Bennett, Chem. Formulary, Vol. 1, p. 428 (1933).
[15] Ibid.
[16] Ibid., Vol. 4, p. 187 (1939).
[17] L. Sonnenborn Sons, N. Y. C.
[18] Erbs, Fr. 484,382 (1917).
[18a] P. C.
[19] P. C.

FORMULA No. 21.

Paraffin Oil (28 to 30° Bé)	250	Caustic Soda	3
Rosin	22	Water	10
Oleic Acid	22	Alcohol [20]	7

FORMULA No. 22.

Potash Soap	30	Cyclohexanol	2
Olein	7	Paraffin Oil [21]	32

FORMULA No. 23.

Sodium Naphthenic Sulfonate	12.00	Alcohol	0.50
Naphthenic Acid	3.00	Water	2.00
Sodium Hydroxide	0.50	Montan Wax	0.05
		Paraffin Oil [22]	81.95

FORMULA No. 24.

Sodium Naphthenic Sulfonate	12.00	Alcohol	0.50
Rosin	4.60	Water	2.00
Sodium Hydroxide	0.50	Montan Wax	0.05
		Paraffin Oil [22]	80.35

FORMULA No. 25.

Pine Oil	2.5	Alcohol, Anhydrous	5.
Red Oil	12.0	Potassium Oleo-Abietate [23]	16.
Caustic Potash (50%)	4.		

FORMULA No. 26.

Pine Oil	80	Double Sulphonated Castor Oil [23a]	20

SOLUBLE OIL STABLE TO SEA WATER

FORMULA No. 27.

Pine Oil	12	"Sulfatate" (Or other water-soluble sulfonated hydrocarbon) [24]	6
Red Oil	9		
"Carbitol"	8		
Diglycol Laurate	65		

[20] Bennett, Chem. Formulary, Vol. 3, p. 210 (1936).
[21] Ibid., Vol. 2, p. 303 (1935).
[22] Zimmer, U. S. 2,230,556 (1941).
[23] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[23a] P. C.
[24] Bennett, Chem. Formulary, Vol. 4, p. 95 (1939).

Formula No. 28.

Miscibol	16.	Isopropanol	5.
Oleic Acid	12.	Pine Oil [25]	2.5
Caustic Potash (45%)	3.		

Formula No. 29.

Sodium Abietate	25	Pine Oil	4
Oleic Acid	10	Isopropanol [26]	6

Formula No. 29A.

Steam Distilled Pine Oil	50	Caustic Soda (27° Bé.)	10
Sulphonated Castor Oil (75%)	50	Water	40

Heat the pine oil to 38°C. in a lead lined tank, add the sulphonated castor oil, then add the caustic soda gradually with agitation, maintaining the temperature noted above with constant agitation. When a nearly clear solution is obtained, add the water slowly, continuing agitation, then allow to cool rapidly.[27]

Formula No. 30.

Soya Oil Fatty Acid or Linseed Oil Fatty Acid	25	Pine Oil	35

Warm gently with the following solution:

Water	10	Pine Oil [28]	160
Caustic Potash (50° Bé)	10		

Formula No. 31.

Spindle Oil, Refined 4–5 E. (20°C.)	50.0	Alcohol, To make clear [29]	about 12.5
Oleic Acid, Distilled	20.0		
Sodium Hydroxide (29° Bé.)	about 12.5		

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[25] P. C.
[26] P. C.
[27] Bennett.
[28] Ibid., Vol. 3, p. 325 (1936).
[29] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).

FORMULA NO. 32.

Spindle Oil	100.0	Triethanolamine	0.5
Oleic Acid	12.0	Caustic Potash (38° Bé)	4.5
Butanol	7.0		

Heat the oils to about 70°C., add the butanol, and to this the triethanolamine. Add the lye, and leave standing hot to clarify.[30]

FORMULA NO. 33.

Talloil, Refined	20	Alcohol	To clear
Spindle Oil, Refined	72	Fatty Acid[31]	A little, to clear
Caustic Soda (38° Bé.)	8		

FORMULA NO. 34.

Naphthenesulphonic Acids	15	Caustic Potash (25° Bé.)	Until neutral
Olein (or Liquid Wool Fatty Acid)	5–7	Hexalin and Tetralin (1:1)[32]	3–4
Spindle Oil, Refined (60°C.)	75		

FORMULA NO. 35.

Rosin Soap	25	Pine Oil	4
Red Oil	10	Alcohol, Anhydrous[33]	6

FORMULA NO. 36.

Olein	16	Caustic Soda (36° Bé.)	6
Spindle Oil Refined	73	Alcohol, Denatured[34]	5

FORMULA NO. 37.

Olein	20	Caustic Potash[35] (40° Bé.)	8
Spindle Oil, Refined	72		

FORMULA NO. 38.

Talloil, Refined	20	Caustic Potash[36] (36° Bé.)	10
Spindle Oil, Refined	70		

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[30] Ibid.
[31] Ibid., p. 207 (1939).
[32] Ibid., Vol. 3, p. 213 (1936).
[33] Bennett, Chem. Formulary, Vol. 4, p. 95 (1939).
[34] Ibid., p. 206 (1939).
[35] Ibid.

FORMULA No. 39.

Talloil, Refined	20	Caustic Soda [37] (36° Bé.)	8
Spindle Oil, Refined	72		

FORMULA No. 40.

Train Oil Fatty Acid	20	Caustic Potash (40° Bé.)	7
Spindle Oil, Refined	70	Hexalin [38]	3

FORMULA No. 41.

Naphthenic or Hydroxy Fatty Acid	12	Caustic Soda (36° Bé.)	6
Spindle Oil, Refined	80	Benzoline [39]	2

FORMULA No. 42.

Colophony (Rosin)	8	Spindle Oil, Refined	78
Olein	6	Caustic Soda [40] (24° Bé.)	8

FORMULA No. 43.

Turkey Red Oil	15	Spindle Oil, Refined	65
Olein	10	Caustic Potash [41] (40° Bé.)	10

FORMULA No. 44.

Bone Fat Fatty Acid	20	Spindle Oil, Refined	63
Olein	5	Caustic Soda [42] (24° Bé.)	12

FORMULA No. 44a.

Lanolin Fatty Acids	16	Caustic Potash [43] (24° Bé.)	9
Spindle Oil, Refined	75		

FORMULA No. 44b.

Woolfat Fatty Acids	7	Spindle Oil, Refined	77
Lanolin Fatty Acids	8	Caustic Soda [44] (24° Bé.)	8

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[37] Ibid.
[38] Bennett, Chem. Formulary, Vol. 4, p. 206 (1939).
[39] Ibid.
[40] Ibid.
[41] Ibid.
[42] Ibid.
[43] Bennett, Chem. Formulary, Vol. 4, p. 206 (1939).
[44] Ibid.

FORMULA No. 45.

Olein	18	Caustic Potash (40° Bé.)	7
Spindle Oil, Refined	45	Water [45]	30

The amount of caustic must be varied since the saponifiable materials are not constant in acidity.

FORMULA No. 46.

Glyceryl Monostearate	75 g.	Sodium Salt of Sulphonated Oleyl Alcohol	50 g.
Sperm Oil	150 g.	Water	1200 g.

Warm and mix vigorously.[46]

FORMULA No. 47.

Sulphonated Oil	11.5	Oleic Acid	10.5
Soap	17.5	Mineral Oil	2.0
Cottonseed Oil	8.5	Water [47]	50.0

FORMULA No. 48.

"Carbitol"	5	Orthodichlorbenzol [48]	400
Diglycol Laurate	95		

FORMULA No. 49.

Sulfonated Castor Oil	70	Tetrahydronapthalene	15
Turpentine	10	Pine Needle Oil [49]	5

FORMULA No. 50.

Tetralin	15	Pine Needle Oil	
Turpentine	10	Sulfonated Vegetable Oil [50]	70

FORMULA No. 51.

Sal Soda	¼ lb.	Soft Soap	½ pt.
Lard Oil	½ pt.	Water	To make 10 qt.

Boil the above ingredients for one-half hour and place in suitable containers for use as needed.[49]

[45] Ibid.
[46] Ibid., p. 207 (1939).
[47] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[48] Ibid., Vol. 4, p. 95 (1939).
[49] Muncheburg, Fr. 674,816 (1929).
[50] Muncheburg, Fr. 674,816 (1929).
[49] Bennett, Chem. Formulary, Vol. 2, p. 303 (1935).

METAL DRAWING COMPOUNDS

FORMULA No. 1.

Lard Oil, Prime	40 lb.	Water [50]	50 gal.
Diglycol Laurate	10 lb.		

FORMULA No. 2.

1. Soap, Neutral	10 lb.	4. Mineral Oil	20 lb.
2. Diglycol Laurate	7 lb.	5. Water	200 gal.
3. Lard Oil, Prime	13 lb.		

Warm, together, 1, 2, 3 and 4 until clear and pour into water slowly and mix well. In certain cases it is desirable to add

White Lead [51]	3 lb.

FORMULA No. 3.

Diglycol Stearate	6	Water [52]	56
Glycowax A	2		

FORMULA No. 4.

Sodium Alginate	1	Soap	2
Tallow	4	Water [53]	195

FORMULA No. 5.

Tallow	3.0	Soap	0.5
Rape Seed Oil	1.5	Water	95.0

Warm together and emulsify. In using maintain pH at 8–9.[54]

FORMULA No. 6.

One part of soluble alginate, four parts of tallow, two parts of soap, and one hundred and ninety five parts of water.[55]

[50] Ibid., Vol. 4, p. 202 (1939).
[51] Ibid.
[52] Ibid.
[53] Bennett, Chem. Formulary, Vol. 3, p. 211 (1936).
[54] Ibid., Vol. 4, p. 202 (1939).
[55] Ibid., Vol. 2, p. 300 (1935).

Formula No. 7.

Tallow	60 lb.	Water	92 gal.
Yellow Soap	15 lb.		

Heat and stir until smooth.[56]

Formula No. 8.

Sulfated Higher Fatty Alcohol	3	Water [57]	20
Tallow	20		

NAPHTHENIC MISCIBLE OILS

Formula No.	1	2	3	4	5	6	7	8	9	10
1. Potassium naphthenate from—										
Heavy gas oil	65	48								
Light lube oil			37	37	37	23	20	30		
Heavy lube oil									13	30
2. Light lube oil	20	35	50	45	50	58	62	55	69	64
3. Common solvents										
Group 1—Water soluble										
Ethylene Glycol										3
Diethylene Glycol	5	5	5	5	5	5	5	5	5	
Group 2—Oil soluble										
Sub-group A										
Pine Oil		10		10						
Alpha Terpineol	5		5			5	5	10	5	
Octyl Alcohol					5					
Sub-group B										
Rosin	5					5			5	3
Cresylic Acid							5			
4. Water [58]		2	3	3	3	4	3		3	

[56] Ibid., Vol. 3, p. 209 (1939).
[57] Williams, U. S. 2,152,396 (1939).
[58] Bradley, U. S. 2,289,536 (1942).

CHAPTER III

EMULSIFYING AGENTS

FORMULA NO. 1.

10 kilograms of casein and 10 kilograms of citric acid are stirred up and heated with 100 liters of water, and the solution is then diluted with a further 200 liters of water, the undissolved parts being removed. Potash lye is then added hot until the concentration is pH 7.4, and the solution is carefully evaporated. A homogeneous residue is thus obtained which is completely soluble in water, and is admirably adapted either as an emulsifying agent or detergent, either by itself or with fat solvents or neutral soap, especially for wool scouring.[1]

FORMULA NO. 2.

a. Pectin, Dry	4–5	Gelatin	½
Agar-Agar	1	b. Water, Boiling	100

Dissolve a in b, cool. The smooth jelly that forms is liquefied once again by stirring and run through a homogenizer.

The viscous liquid thus formed can be used to emulsify oils in varying amounts.[2]

[1] Bennett, Chem. Formulary, Vol. 2, p. 181 (1935).
[2] Ibid., Vol. 4, p. 95 (1939).

FORMULA No. 3.

Cottonseed Oil	75	Potassium Carbonate	
Diethylene Glycol	22		

Heat with good stirring, for 1 hour, at 125–130°C.

This is soluble in mineral oil and disperses in warm water.[3]

FORMULA No. 4.

Castor Oil	46.6	Diethylene Glycol	44.0
Soya Bean Oil	112.5	Potassium Carbonate	2.0

Method as above.[4]

FORMULA No. 5.

Coconut Oil	137	Potassium Carbonate	2
Diethylene Glycol	44		

Method as above.[5]

FORMULA No. 6.

Palm Kernel Oil	150	Potassium Carbonate	5
Diethylene Glycol	44		

Method as above.[6]

FORMULA No. 7.

Castor Oil, Blown	85.0	Sodium Hydroxide[7] (10%)	6.7
Castor Oil Fatty Acids	15.0		

FORMULA No. 8.

Diglycol Laurate	80	"Carbitol"	20

A good white water in oil cream emulsion is obtained from

Above emulsifier	15	Water[8]	45
Mineral Oil	40		

[3] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[4] Ibid.
[5] Ibid.
[6] Ibid.
[7] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[8] Ibid.

FORMULA No. 9.

Pectin	4–5	Gelatin	½
Agar	1	Water (Boiling)[9]	100 cc.

FORMULA No. 10.

Soya Bean Flour	1.0	Caustic Potash	0.1
Water	150.0		

Heat together and stir until uniform.[10]

FORMULA No. 11.

Pectin	2–5	Gelatin	0–1
Agar	0.5–1.5	Gum Arabic[12]	0–5

FORMULA No. 12.

Gum Tragacanth	20	Sodium Bicarbonate[13]	13
Gum Arabic	5		

FORMULA No. 13.

Gum Tragacanth	20	Sodium Bicarbonate[14]	13
Locust Bean Gum	15		

FORMULA No. 14.

Powdered Acacia	5	Starch	5
Powdered Tragacanth	5	Boric Acid	1
Sugar	5		

Mix intimately. Use 1 part of above powder to every 32 parts of emulsion to be made. Eight ounces of the oil to be emulsified is put into a dry 32 ounce bottle, and shaken with ½ ounce of the above. When the powder is evenly suspended, 8 ounces of water is added at once, and the mixture is well shaken until a perfect emulsion is formed.[15]

FORMULA No. 15.

Aerosol OT (100%)	40	Triethanolamine	18
Oleic Acid	42		

[9] Ibid.
[10] Ibid.
[12] Preiser, Brit. 486,463 (1938).
[13] P. C.
[14] P. C.
[15] Bennett, Chem. Formulary, Vol. 2, p. 181 (1935).

The Aerosol OT (100%) is dissolved in the oleic acid by heating to 50°C to 60°C. The mixture is cooled to room temperature and the triethanolamine added. 5% of this emulsifier can be mixed with 95% of oil and to it added 30% to 50% water, whereupon a thick creamy paste will be obtained, which can be further diluted with additional water.[16]

FORMULA No. 16.

55 parts of lauryl amide are mixed with 50 parts of formaldehyde (30 per cent), 0.5 part of potassium hydroxide solution (50 per cent concentration) and 300 parts of water. The mixture is agitated for half an hour at a temperature of 60 degrees C. It is agitated for another hour after the addition of 50 parts of phenol and 10 parts of concentrated solution of hydrochloric acid. The viscous oil, obtained from this treatment, is an excellent emulsifier. It is mixed with 200 parts of sulfuric acid (monohydrate) at a temperature of 60° to 70°C., and after the sulfonated mixture has been agitated for several hours, it is mixed with 200 parts of ice and slowly heated with agitation to a temperature of approximately 70°C. After agitation is stopped, the sulfonate formed quickly separates in the state of a viscous oil over an aqueous solution of sulfuric acid. The latter is removed and the oily sulfonic acid is dissolved in water, neutralized and evaporated. A product is finally obtained which possesses high detergent powers both in hard and soft water and is resistant to the action of hot acids and alkalies.

FORMULA No. 17.

380 kilograms of octadecanolamine hydrochloride are introduced into 200 kilograms of trichlorethylene and sulphonated at 10°C. with 120 kilograms of chlorsulphonic acid. The product is pressed on ice, washed with saturated

[16] Amer. Cyanamid & Chem. Corp., New York.

Glauber's salt solution in order to remove the excess of sulphuric acid and acetic acid and neutralized with caustic soda solution.[17]

[17] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).

CHAPTER IV

BITUMINOUS EMULSIONS

ASPHALT EMULSIONS

Formula No. 1.

Asphalt	64.05	Corn Gluten (or Soy Bean Meal)	.64
Water	35.00	Green Acid Soap (Dry Basis)	0.23
Caustic Soda	.08		

The asphalt for use in this formula may be produced from Mid-Continent petroleum; it may have a melting point of about 110°F. and a penetration of about 130 at 77°F.

Green acid soap is a composition of preferentially water soluble petroleum sulfonic salts. This soap may be prepared by the neutralization of green acids, which are well known in the petroleum industry. If the green acid soap contains appreciable amounts of oil, a harder asphalt should be emulsified, to produce a residue of given penetration, than is necessary when the green acid soap is free from oil.

In preparing the emulsion the procedure is as follows: The caustic, farinaceous emulsifier, and green acid soap are mixed with water and heated to a temperature of about 200°F. This hot solution or mixture is placed in a suitable stirrer, agitator or mixer and is beaten by paddles, circulated by centrifugal pumps or dispersed between suitable rotors moving at high velocities.

The melted asphalt at about the same temperature is

slowly stirred into the solution and further agitated until complete emulsification has taken place. When high melting point asphalts are used it may be necessary to increase the temperature at which the asphalt is added, but it is desirable to keep the temperature of the emulsion below the boiling point of water so that the foaming due to the production of steam may be prevented.[1]

FORMULA No. 2.

A sodium oleate solution is made up to a concentration of 20 per cent by the addition of oleic acid and caustic soda to water at 90°C. This is then diluted with 9 times its volume of water heated to 90°C. The 2 per cent soap solution is run through a colloid mill with an equal amount of asphalt heated to not exceeding 100°C. The resultant emulsion contains equal parts of asphalt and water with 1 per cent by weight of soap.[2]

FORMULA No. 3.

A hot dilute aqueous solution of alkali such as a solution of caustic soda of about 0.5% strength is prepared and about an equal weight of asphalt is melted; part of the melted asphalt is stirred into the hot solution slowly until scum begins to form on the surface, then a small quantity (suitably about 0.5% of the final product) of oleic acid is added, followed by addition of the rest of the asphalt while the temperature and agitation are maintained and a small proportion of clay is added to give desired stability and adhesiveness.[3]

FORMULA No. 4.

Rosin	100	Slaked Lime

[1] Bennett, Chem. Formulary, Vol. 2, p. 187–188 (1935).
[2] Bennett, Chem. Formulary, Vol. 1, p. 163 (1933).
[3] P. C.

Heat at 140°C. and mix until uniform.
Add while mixing

Fuel Oil	103

Take 4 lbs. of above mixture and add to 100 lb. melted bitumen or asphalt and then disperse mixture in 0.05 N potassium rosinate solution to give a 57% bitumen content.[4]

Formula No. 5.

A part of molten asphalt is added to a hot, dilute, aqueous solution of caustic soda, an emulsifying agent, e.g., oleic acid, is added, and then the remainder of the asphalt, all with agitation; at an appropriate time of the operation, e.g., before adding the asphalt, a small proportion of colloidal clay is added as a stabilizer. A suitable emulsion may contain asphalt 48–52%, water 46–48%, oleic acid 1%, sodium hydroxide less than 1%, bentonite 1%.[5]

Formula No. 6.

This consists in dissolving substantially 9 parts, by weight, of soap in substantially 78 parts of weight of warm water. To the soapy water thus formed is slowly added, with vigorous agitation, about 20 parts, by weight; of a low grade fuel oil or a crude oil having an asphaltic base, to produce a dispersion of the oil, in the warm soapy water.[6]

Formula No. 7.

Asphalt	500	Quebracho	30
Water	500	Soda Ash	10
Bentonite	30		

Combine the bentonite, quebracho, soda ash and water and heat to 200°F. While stirring, add the asphalt which

[4] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[5] Ibid., Vol. 2, p. 186 (1934).
[6] Ibid

has been heated to approximately 200°F. Continue stirring until the asphalt is dispersed.[7]

FORMULA NO. 8.

Asphalt	2800	Rosin Soap (50%)	118
Water	2800	Pine Oil	40

Add the rosin soap to water and heat to 200°F. Heat the asphalt to 200°F. and add the pine oil. While agitating, slowly pour the asphalt into water and continue agitating until a smooth emulsion is formed.[8]

FORMULA NO. 9.

Hydrous Magnesium Silicate	8–10 lb.	Water	20 gal.

Mix well and heat to a boil; then mix in an emulsifying machine with

Asphalt (Melted)	36 gal.	Water (Boiling)[9]	10 gal.
Acetic Acid (0.1 N.)	250–420 cc.		

FORMULA NO. 10.

Shale asphalt, consisting of residues obtained after distilling crude shale oil, is heated to about 300° and distd. in steam at 325° to drive off traces of oil, and mixed with montan wax and a fatty acid at 120–30° in the proportions asphalt 50, wax 1–2 and fatty acid 0.5–2.5. The molten mixture is led in fine stream with stirring into an aqueous caustic soda of soap solution at 90°C. in proportions water 15–20, a caustic soda 0.3–0.6 and fatty acid 0.4–0.5. The emulsion is then boiled for 2–10 minutes, and may be mixed at a temperature not above 55°C. with rubber latex, such as Revertex.[10]

[7] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).
[8] Ibid.
[9] Ibid., Vol. 4, p. 96 (1939).
[10] Ibid., p. 97 (1939).

BITUMEN EMULSIONS

Formula No. 1.

1,000 g. bitumen (preferably asphalt) are heated to 90°C. 60 g. Swedish resin at 80–90°C. is then added and finally a solution of 20 g. caustic potash in 120 g. water, cooled to 60–70°C., is added. Vigorous stirring is needed throughout. 1000 g. hot water is poured in and when soap formation is ended a further 800 g. water is added.[1]

Formula No. 2.

Add 15 parts by weight of oleic acid to 250 parts by weight of asphalt flux oil, heating the mix to about 100°C., adding the same to 750 parts of water to which have been added 34 parts of aqueous ammonia whereby an emulsion of the asphalt flux oil, which has a viscosity substantially greater than that of water is produced, thereafter adding 1500 parts by weight of coal tar, which has a specific gravity of about 1.18 or more, heated to a temperature of about 70°C. to which has been added 45 parts of oleic acid. Vigorously agitate the tar with the emulsion of asphalt flux oil, and subject the resulting mixed emulsion to intensive mechanical disintegration, as for example, by passage through a colloid mill.[2]

Formula No. 3.

An emulsion for road making contains Spramex bitumen 48, water 49.5, oleic acid 2 and calcined sodium carbonate 0.5%. The bitumen is warmed at 95–98°, and the oleic acid added. The water is heated separately with the sodium carbonate and the two liquids are introduced into the emulsifier. Another emulsion contains Spramex bitumen 50, mineral oil 2–2.5, resin soap 1.5–2, caustic potash 1, and water 45%. The bitumen is melted and the mineral oil added during

[1] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[2] Ibid.

agitation. The water is heated to boiling, and in it are dissolved the soap and the caustic potash. The liquids are mixed at 95°. With more bitumen there must be added 1–2% of glue, starch, gelatin or sodium silicate, during or after emulsification.[3]

Formula No. 4.

Melt 100 parts of bitumen, having a softening point of 45° to 50°C., and add 10.8 parts of rosin, and heat to 100–125°C. Then add 20 parts of kaolin (swollen in equal parts by weight with water), and 1.2 parts of sodium hydroxide, preheated to 70° to 80°C. Raise the temperature of this mixture to 100°C., and dilute with water to produce an emulsion containing 20 to 25% of solids.[4]

Formula No. 5.

Bitumen	35 lb.	Carragheen[5]	1 lb.
Coal, Powdered	15 lb.	Water	50 lb.

PITCH EMULSION

Coal Tar Pitch	180	Stearin Pitch	20

Melt together and add to following at 100°C.

*Casein Solution	45	Caustic Potash	1
Water	35		

Then add

		Water, Boiling	120

*CASEIN SOLUTION =

Casein	56	Water	494
Caustic Potash (50%)	10	Cresylic Acid[6]	11

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[3] Bennett, Chem. Formulary, Vol. 1, p. 329 (1933).
[4] Ibid., Vol. 5, p. 72 (1941).
[5] Ibid.
[6] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).

TAR ASPHALT EMULSION

Shale Tar	38.15 lb.	Rosin	1.15 lb
Water	49.60 lb.	Potato Starch	0.76 lb
Mexican Asphalt	7.63 lb.	Anthracene Oil [7]	1.34 lb
Casein	1.15 lb.		

[7] Ibid., Vol. 5, p. 73 (1941).

CHAPTER V

CLEANERS AND SOAPS

DRY CLEANERS' SOAPS

FORMULA No. 1.

Xylol	10	Diglycol Laurate	7
Carbon Tetrachloride	10	Water	23

Add other materials slowly to water while mixing with a high speed stirrer.[1]

FORMULA No. 2.

a. Oleic Acid	46.0	c. Alcohol	45.4
b. Caustic Soda (25%)	27.0	d. Trichlorethylene	900.0

Saponify a with b on a waterbath. Add c and reflux to clear solution. Add this clear alcoholic soap solution to d with stirring, and let cool.[2] Water emulsifies this fluid readily.

FORMULA No. 3.

Oleic Acid	370	Water	70
Stearic Acid	80	Benzine	395
Potassium Carbonate	80	Stronger Ammonia Water	5

Melt the stearic acid and dissolve it in the warmed oleic acid. To this add the warm benzine and mix thoroughly.

[1] Bennett, Chem. Formulary, Vol. 4, p. 497 (1939).
[2] Ibid.

Dissolve the carbonate in the water and add this, with constant stirring, into the benzine mixture. Finally add the ammonia and beat into a homogeneous paste.[3]

FORMULA No. 4.

Liquid Soap (15%)	40	Alcohol (Methyl Glycol, Ethanol, etc.)[1]	25
Hydrocarbon Solvent	10		
Turkey Red Oil or Other Emulsifier	25		

FORMULA No. 5.

1. Trihydroxyethylamine Stearate	5	3. Cresylic Acid	1
2. Kerosene	16	4. Water (Boiling)	45

Heat (1) and (2) until dissolved; add (4) slowly while stirring with high speed mixer then add (3).[2]

PINE OIL SOAP

FORMULA No. 1.

Glycol Laurate	5	Pine Oil	25

Mix and add to following while stirring vigorously

Water	50	Caustic Soda[3]	¼

FORMULA No. 2.

Water	8.0	Pine Oil	18.0
Solid Caustic Soda	2.5	Red Oil (Oleic acid)	17.5
Alcohol	10.0	Water	44.0

Mix the ingredients, while stirring in the order given, at a temperature of about 40°C.; finally adjust with red oil or alkali until a sample dissolved in alcohol is neutral to phenolphthalein.[4]

[3] Ibid., Vol. 1, p. 76 (1933).
[1] Bennett, Chem. Formulary, Vol. 4, p. 496 (1939).
[2] Ibid., Vol. 1, p. 76 (1933).
[3] Ibid., Vol. 3, p. 325 (1936).
[4] Bennett, Chem. Formulary, Vol. 1, p. 84 (1933).

FORMULA No. 3.

Potash Corn Oil Soap	96–97	Pine Oil [5]	4–3

EMULSION SOLVENT SOAPS

FORMULA No. 1.

Pine Oil	300	Water	60
Soya Bean Oil Fatty Acid	100		

Warm gently to be liquefied, then add

Caustic Potash (50° Bé.)	40

1 part of the above mixes with

Turpentine	4
	or
Benzoline	4
	or
Carbon Tetrachloride	4
	or
Dichloroethylene	4
	or
Naphtha	4

These give excellent emulsions in water (1:1 to 1:2).

FORMULA No. 2.

Pine Oil Soap (Above)	12.5	Spindle Oil (Refined	
Pine Oil	12.5	2°Engler, at 50°C.)	75

Yields a clear oil that gives excellent emulsions with water.[1]

FORMULA No. 3.

Oleic Acid	107.0	Triethanolamine	19.7
Butyl Cellosolve	27.0	Potassium Hydroxide	8.3
Cleaner's Naphtha	25.0	Water	13.5

[5] P. C.
[1] Bennett, Chem. Formulary, Vol. 3, p. 324 (1936).

The oleic acid, butyl cellosolve and naphtha are thoroughly mixed and heated to 140°F. in the absence of flames. In a separate container the potassium hydroxide is dissolved in the water and mixed with the triethanolamine. The water solution is then stirred into the oleic acid solution, and stirring is continued for about 30 minutes until a clear stable solution is produced.[2]

FORMULA NO. 4.

Linseed Oil	500	Potash Lye (50° Bé.)	199
Hexalin	250-300	Water[3]	1208

FORMULA NO. 5.

Linseed Oil Fatty Acids	500	Potash Lye (50° Bé.)	208
Methyl Hexalin	750	Water[4]	292

FORMULA NO. 6.

Coconut Oil Fatty Acids	500	Potash Lye (50° Bé.)	270
Hexalin-Methyl Hexalin (1:1)	250	Water[5]	1300-1800

The ingredients are stirred together in a double boiler until a clear solution is formed; this is tested for alkalinity.

FORMULA NO. 7.

Linseed Oil	184	Water	387
Hexalin	275	Carbon Tetrachloride[6]	80
Potash Lye (50° Bé.)	73.5		

FORMULA NO. 8.

Coconut Oil	51	Potash Lye (50° Bé.)	42
Linseed Oil	42	Water	615
Hexalin	130	Carbon Tetrachloride[7]	120

Equal weights of benzine or high-boiling petroleum distillates may be used in place of carbon tetrachloride.

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[2] Ibid., Vol. 1, p. 79 (1933).
[3] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[4] Ibid.
[5] Ibid.
[6] Ibid.
[7] Bennett, Chem. Formulary, Vol. 3, p. 322 (1939).

FORMULA No. 9.

Soap	35	Water [8]	55
Cyclohexanol	10		

FORMULA No. 10.

Soap	28	Water	60
Trichloroethylene	10	Potassium Carbonate [9]	2

FORMULA No. 11.

Soap	30	Water [10]	45
Trichloroethylene	25		

FORMULA No. 12.

Soap	5	Cyclohexanol	10
Ammonia (0.880)	25	Water [11]	60

FORMULA No. 13.

Soap	10	Tetralin	10
Ammonia (0.880)	5	Water [12]	75

AUTO RADIATOR CLEANER

Kerosene	25	Diglycol Oleate	5
Orthodichlorobenzene	25	Water	40
Borax	5		

The borax is dissolved in the water and the other ingredients are dissolved in the kerosene, and the two solutions are then emulsified together, making a stable emulsion.

When the cleaning composition is to be used, it is added to the water in the cooling system of an engine, and the engine is set in operation so that the water, by its circulation, carries the emulsion to all parts of the system. While the water is still cool the oily ingredients, together with the diglycol oleate dissolved in them, penetrate the solid deposits in the system,

[8] Ibid.
[9] Ibid.
[10] Ibid.
[11] Bennett, Chem. Formulary, Vol. 3, p. 322 (1939).
[12] Ibid.

and dissolve or soften any grease contained in the deposits. When the water is sufficiently heated, by the continued operation of the engine, the borax reacts with the diglycol oleate to produce a water-soluble soap, thus disintegrating the deposits and producing an oil-in-water emulsion. The cooling water and the emulsified materials are then drained from the system, and any remaining solids, having been loosened and disintegrated, may be flushed from the system with additional water.[1]

CHROMIUM PLATE CLEANERS

Formula No. 1.

Amorphous Silica	5.0	Triethanolamine Oleate	3.0
Bentonite	1.0	Oleic Acid	0.5
Orthodichlorobenzene	10.0	Water [2]	80.0

Formula No. 2.

Bentonite	5.	Orthodichlorobenzene	40.
Stearic Acid	5.	Water [3]	50.

Formula No. 3.

Mineral Oil	13.0	Tripoli	25.0
Pine Oil	3.0	Ammonia	0.5
Ammonium Oleate	2.0	Water [4]	54.0
Ammonium Oxalate	3.0		

GRAPHITE CLEANER

Hexalin	2 qt.	Soap Solution (1%)	3 gal.
Pine Oil	4 qt.		

These are mixed together to form a fairly stable emulsion. Hot water is added while stirring constantly until the emulsion is diluted to 50 gallons.[5]

[1] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[2] Ibid.
[3] Ibid.
[4] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[5] Ibid., Vol. 4, p. 501 (1939).

INK CLEANER

Formula No. 1.

a. Naphtha	10	b. Ammonium Sulphate	25
Trichlorethylene	20	Water	100
Methyl Hexalin	5	c. Pumice Powder 000	equal parts
Soft Soap	25	Chalk Powder	

Mix solution a with a paste prepared from b and c.[1]

Formula No. 2.

a. Pumice Powder	50	b. Turpentine	equal parts
Soap Powder	30	Methyl Hexalin	
Trisodium Phosphate	15	Carbon Tetrachloride[2]	
Ammonium Sulphate	5		

LACQUER REMOVER FOR HANDS

Butyl Acetate	13	Diatromaceous Earth	14
Soap	15	Sand	19
Carbon Tetrachloride	7	Water[3]	25
Glycerin	7		

LEATHER CLEANER

Castile Soap (Powd.)	6	Water	160

Boil until dissolved; cool and add

Ammonium Hydroxide	6	Ethylene Dichloride[4]	7
Glycerin	14		

GREASY LEATHER CLEANER

Water	10 gal.	Methyl Acetone	.5 gal.
Castile Soap	.75 lb.	Lemon Grass Oil[5]	.15 lb.
Trichlorethylene Soap	3.5 lb.		

Dissolve soap in water by heating and stirring. Cool and stir in other ingredients.[5]

[1] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[2] Ibid.
[3] Bennett, Chem. Formulary, Vol. 4, p. 511 (1939).
[4] Ibid., Vol. 1, p. 77 (1933).
[5] Ibid., Vol. 4, p. 511 (1939).

METAL CLEANER

Fatty Acid	8	Fatty Alcohol Sulfate ("Wetanol")	2
Alcohol	15	Neuburg Chalk[6]	50
Ammonia (sp. g. 0.91)	4		
White Spirit	58		

SOAP PASTE PAINT CLEANER

FORMULA No. 1.

Soap Chips	20.00	Water	69.30
Mineral Spirits	10.00	Sassafras Oil[7]	.07

FORMULA No. 2.

a) Naphtha	½ gal.	b) Trisodium Phosphate	4 oz.
Diglycol Stearate	1 lb.	Water	3 qt.

Heat a) on a water bath and stir until dissolved. Heat b) to a boil and run into a) slowly while mixing vigorously.[8]

PAINTED WOODWORK CLEANER

FORMULA No. 1.

Diglycol Stearate	1 lb.	Trisodium Phosphate	4½ oz.
Kerosene	¼ gal.	Water	12 pt.

The diglycol stearate and kerosene are heated together in a double boiler until the stearate is thoroughly dissolved. The trisodium phosphate is dissolved in the water and heated in another container to a temperature of about 150°F. The hot water solution is then added to the hot kerosene solution while stirring at high speed. Stirring should be continued at a good rate until the mixture is of even milky consistency. Mixing may be continued at a slow rate until the batch has cooled to around 85°F. This product is applied in the usual manner by rubbing with a rag or cloth.[1]

[6] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[7] Ibid., Vol. 3, p. 325 (1936).
[8] Ibid., Vol. 4, p. 511 (1939).
[1] P. C.

FORMULA NO. 2.

Diglycol Stearate	1 lb.	Trisodium Phosphate	4½ gal.
Kerosene	gal.	Water	¾ gal.

Melt the diglycol stearate in the kerosene on a water bath (double boiler). In a separate container dissolve the trisodium phosphate in the water and heat to 150°F. Add the hot water solution to the hot kerosene solution while stirring at high speed. Stirring should be continued until the batch has cooled to 85°F. Rapid mixing is essential. This cleaner quickly removes dirt from paint when applied with a cloth. Upon rubbing the cleaned surface acquires a good natural luster, due to the thin colorless protective coating of diglycol stearate. This product cleans and shines in one operation.[2]

FORMULA NO. 3.

DUPONOL LS Paste or DUPONOL ES Paste	47.6	Hexalin	4.8
		Tetralin	47.6

Prepare by adding the DUPONOL LS Paste to the previously mixed solvents.[3]

FORMULA NO. 4.

DUPONOL LS Paste	15	Tetralin	70
Hexalin	2	Water	10
Pine Oil	3		

Prepare by mixing together at room temperature the DUPONOL, Hexalin and Pine Oil. Stir until a clear mixture is formed. Continue stirring and add the Tetralin slowly. After the Tetralin has been added and the mixture thoroughly agitated, add the water and stir until a homogeneous milky emulsion is formed.[4]

[2] P. C.
[3] E. I. Du Pont de Nemours & Co., Wilmington, Del.
[4] E. I. Du Pont de Nemours & Co., Wilmington, Del.

RUG CLEANERS

Formula No. 1.

Di-Glycol Oleate	44	Oleic Acid	11
Butyl Cellosolve	5	Ammonium Hydroxide	11
Ethylene Dichloride	12	Water	45
Alcohol	15		

This may be made thinner by increasing the amount of water.[1]

Formula No. 2.

a) Oleic Acid	35	b) Butyl Cellosolve	5
Trigamine	15	Ethylene Dichloride	13
Water	125	c) Diethylene Glycol	15
		Isopropyl Alcohol	20

Mix a) and add b) with high speed agitation. Add c) slowly.[2] Continue stirring.

Formula No. 3.

Oleic Acid	28	Triethanolamine	15
Butyl Cellosolve	5	Water	125
Ethylene Dichloride	13	Isopropanol	14

The oleic acid, ethylene dichloride and butyl cellosolve are mixed and then added to a solution made of the triethanolamine and water. The mixture is stirred well and sufficient isopropanol is added to form a clear solution.[3]

UPHOLSTERY CLEANSER

Coal-Tar Naphtha	27 oz.	Triethanolamine Oleate	1 oz.
Tallow Soap	1 oz.	Water[4]	71 oz.

SADDLE SOAP

Formula No. 1.

Beeswax	500	Water	800
Caustic Potash	80		

[1] Bennett, Chem. Formulary, Vol. 1, p. 77 (1933).
[2] Ibid., Vol. 4, p. 496 (1939).
[3] Bennett, Chem. Formulary, Vol. 1, p. 85 (1933).
[4] Ibid., Vol. 4, p. 497 (1939).

Boil for 5 minutes while stirring. In another vessel heat

Castile Soap	160	Water	800

Mix the two with good stirring; remove from heat and add

Turpentine	1200

while stirring well.[5]

Formula No. 2.

Carnauba Wax	54	Turpentine	21
Soap Flakes	20	Sperm Oil	6
Tallow	26	Water[6]	5

WASHING COMPOUND

Paraffin Wax	8 lb.	Potassium Carbonate	4 oz.
Soap, White	4 lb.	Water	1 gal.
Borax	16 oz.		

Dissolve the borax and carbonate in one-third of the water by heat. Shave the soap and dissolve it in the rest of the water, adding the borax and carbonate solution after the soap has softened. Melt the wax by heating and, while hot, pour into it gradually, the hot soap solution. Remove from the fire, continue stirring until cold.[1]

COMPOSITION TO CLEAN WOODEN SURFACES

Montan Wax, Double Bleached	4	Water	68
Paraffin Wax (50/52°C.)	6	Methyl Alcohol	20
Soap, Castile	1	Ammonia (Concentrated)	1

Color with any water soluble color.[2]

CLEANER EMULSION FOR PRINTING ROLLS

a) Oleic Acid	45.5	b) Alcohol	45.5
Caustic Soda	8.5	c) Trichlorethylene	900.0
Water	26.5		

[5] Bennett, Chem. Formulary, Vol. 1, p. 84 (1933).
[6] Ibid.
[1] Crowley, Money Making Formulas, p. 90 (1939).
[2] P. C.

Saponify a) to give a clear soap gel. Dissolve by working in b); stir steadily and add c) slowly, until completely mixed.[3] Dilute with water for use.

CLEANSER FOR RUBBER RUGS

Oleic Acid	8	Water	30
Triethanolamine	3	Spindle Oil	40

[3] Bennett, Chem. Formulary, Vol. 4, p. 497 (1939).
[4] Bennett, Chem. Formulary, Vol. 4, p. 514 (1939).

CHAPTER VI

COSMETIC AND DRUG EMULSIONS

ALL PURPOSE CREAMS

FORMULA No. 1.

1. Parachol (Absorption Base)	25	5. Ozokerite, White	6
2. Lanolin, Anhydrous	10	6. Glycol Bori-Borate	2
3. Mineral Oil	20	7. Water	50
4. Paraffin Wax	2		

Melt together 1, 2, 3, 4, and 5 on a water-bath and keep at 50°C. Add solution of 6 in 7 heated to 50°C. a little at a time, using a low speed mixer with large paddles. Do not add additional amounts of water until first addition has been absorbed. Stir until temperature falls to 42°C. and then mix in a little perfume. Then pass through an ointment or colloid mill.[1]

FORMULA No. 2.

Sorbitol Di-Stearate	10	Beeswax	4
Mineral Oil	20	Ceresin Wax	10
Lanolin	3	Water[2]	48
Glycerin	5		

FORMULA No. 3.

Beeswax	6.00	Rancidex (Preservative)	0.10
Spermaceti	2.00	Water	25.00
Petrolatum	5.00	Borax	0.60
Raisin Seed Oil	50.60	Triethanolamine	0:20
Mineral Oil	10.00	Perfume	0.50

[1] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[2] Ibid.

Melt fats and oils at 160°F. Water and borax in separate kettle at same temperature. Emulsify by adding water to oils at 160°F. with constant stirring. Add perfume oils at 115°F.[3]

FORMULA NO. 4.

* Cosmetic Base	22	Beeswax (bleached)	7
Mineral Oil	25	Water	43
Lanolin	3		

* The cosmetic base may be made up of 10% sorbitol mono-oleate and 90% petrolatum or 10% sorbitol di-stearate and 90% petrolatum.[4]

SKIN LOTIONS

FORMULA NO. 1.

Mineral Oil	50	Diglycol Laurate	20
Camphor	2		

Mix together until dissolved and add with good stirring

Water[5]	120

FORMULA NO. 2.

Glyceryl Monostearate	6.0	Stearic Acid	1.0
Water	75.5	Oleic Acid[6]	2.0
Glycerin	10.0		

FORMULA NO. 3.

Stearic Acid, Triple Pressed	12	Glycerin	4
White Mineral Oil	30	Perfume	½
Triethanolamine	4	Water[8]	80

FORMULA NO. 4.

* Base Emulsion	550	Perfume	5
Distilled Water	445		

* Base Emulsion

Distilled Water	710	Citric Acid	10
Mineral Oil	180	Extract Chamomile Flowers	50
Dried Pectin	50		

[3] Ibid., p. 49
[4] Ibid.
[5] Ibid., Vol. 5, p. 61 (1941).
[6] Ibid., Vol. 2, p. 146 (1939).
[8] Bennett, Chem. Formulary, Vol. 2, p. 147 (1935).

Moisten the pectin with a little alcohol and then rub with a little water in which the citric acid is dissolved until a fine mucilage is obtained. The pectin swells to a large extent. In the rest of the water dissolve the liquid chamomile extract and the warm solution a little at a time to the pectin mucilage. When all the water has been added, heat until a uniform solution results, avoiding overheating. The oil is then emulsified with this solution, preferably in a colloid mill or a homogenizer.[9]

FORMULA No. 5.

1. Mineral Oil	70	4. Water	70
2. Olive Oil	8	5. Perfume[10]	2
3. Trihydroxyethylamine Stearate (Special)	14		

FORMULA No. 6.

Stearic Acid	3.00	Water	75.85
Alcohol	5.00	Quince Seed	3.50
Mineral Oil	5.00	Perfume	.50
Triethanolamine	2.00	Preservative[11]	.15
Glycerin	5.00		

FORMULA No. 7.

Water, Distilled	74	Citrus Pectin	5
Sesame Oil	20	Citric Acid	1

Vigorous stirring of an acidified 5% pectin solution with 20% Sesame oil yields a stable viscous emulsion which readily disperses when poured into water. If such emulsions are homogenized and kept in closed containers, they will remain stable for years.[12]

FORMULA No. 8.

1. Mineral Oil	72	lb.	3. Water (Warm)	160	lb.
2. Trihydroxyethylamine Stearate (Special)		lb.	4. Perfume		lb.

[9] Ibid., Vol. 3, p. 76 (1936).
[10] Ibid., Vol. 2, p. 136 (1935).
[11] Ibid, p. 144.
[12] Bennett, Chem. Formulary, Vol. 6.

Heat (1) and (2) until just melted together, and stir. Next add (3) slowly with thorough stirring and continue until the batch is homogeneous. Allow to stand one night and stir for 15 minutes before packing.

This cream washes off easily with cold water. The consistency can be changed by varying the amount of water in this formula.[13]

FORMULA NO. 9.

1. Lanolin	20	Vegetable Lecithin	1
Almond Oil	80	2. Triethanolamine	20
Stearic Acid	40	Glycerin	30
Diglycol Stearate	10	Water	800
Vitamin F (50,000 units per g.)	5	3. Perfume[14]	to suit

FORMULA NO. 10.

Beeswax, White	1.00	Borax	2.50
Quince Seed	2.75	Glycerin	3.00
Stearic Acid	1.65	Water[15]	85.45

FORMULA NO. 11.

Glyceryl Monostearate	10	Anhydrous Lanolin	2
Cocoa Butter	2	Stearic Acid	1
Glycerin	5	Water[16]	80

Add the ingredients to the water, turn on the heat and bring to the boiling point with constant stirring. When all the ingredients are melted and a clear emulsion is formed, shut off the heat.

FORMULA NO. 12.

a. Lanolin	12	b. Glycerin	8
Mineral Oil	20	Water	200
Trihydroxyethylamine Stearate (Special)	4¼	c. Benzoate of Soda	¼
Glycosterin	2	Perfume[17]	to suit

[13] Ibid., Vol. 1, p. 109 (1933).
[14] Ibid., Vol. 4, p. 59 (1939).
[15] Bennett, Chem. Formulary, Vol. 2, p. 144 (1935).
[16] Ibid., p. 145.
[17] Ibid., Vol. 1, p. 122 (1933).

FORMULA No. 13.

Spermaceti	2.00	Quince Seed	3.40
White Beeswax	.25	Alcohol	4.00
Glycerin	6.00	Water	80.00
Soap	3.00	Perfume	.50
Borax	.50	Preservative [18]	.15
Sodium Benzoate	.20		

FORMULA No. 14.

Spermaceti	3.75	Borax	.35
White Beeswax	.75	Almond Oil	3.00
Glycerin	2.00	Quince Seed [19]	2.50
Pulverized Neutral White Soap	1.50		

FORMULA No. 15.

1. Mineral Oil	35	4. Perfume (Almond)	1
2. White Wax	2	5. Water	50
3. Trihydroxyethylamine Stearate (Special)	8		

Heat Nos. 1, 2 and 3 together to 140°F. and stir until homogeneous. Heat No. 5 to 140°F. and run in slowly to the above mixture, stirring thoroughly. When the temperature has dropped to 105°F. add the perfume drop by drop, stirring until completely absorbed. Continue stirring until cool and package.[20]

FORMULA No. 16.

Peanut Oil	100	Triethanolamine Oleate	2–4
Lanolin	20	Water [21]	200
"Moldex" (Preservative)	1		

FORMULA No. 17.

Raisin Seed Oil	17.50	Water	70.00
Stearic Acid (Triple Pressed)	5.50	Triethanolamine	1.00
		Alcohol	5.50
"Rancidex"	0.10	Perfume	0.40

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[18] Ibid., Vol. 2, p. 144 (1935).
[19] Bennett, Chem. Formulary, Vol. 2, p. 144 (1939).
[20] Ibid., Vol. 1, p. 123 (1933).
[21] Ibid., Vol. 4, p. 56 (1939).

Melt oil, stearic acid and preservatives at 155°F. Bring water and triethanolamine to same temperature. Add oils to water at 155°F. with slow stirring. Stir until cold. Add alcohol and perfume last.[22]

FORMULA No. 18.

Lanolin	2	Glycol Bori-Borate	3
Glycosterin	19	Water [23]	72
Dextrin	4		

FORMULA No. 19.

a. Myristyl Alcohol	30	*b*. Glycerin	7
Petroleum Jelly	9	Water	30

Melt *a* on the waterbath. Heat *b* to 60°C., and add it to *a* with agitation. Stir till cooled.[24]

BEAUTY MILK

Mineral Oil	12.0	Stearic Acid	5.0
Grapeseed Oil	6.0	Glycerin	4.0
Cetyl Alcohol	1.0	Distilled Water	70.00
Triethanolamine	2.0	Perfume [1]	To suit

ACID SKIN MILK

Olive Oil (Deodorized)	10	Acimul	12
Paraffin Wax	6	Water	110
Liquid Paraffin	5	Lemon Juice	3
Petroleum Jelly	10	Preservative [2]	To suit

BATH MILK

Triethanolamine	1	Acacia or Quince Seed	
Stearic Acid	5	Mucilage	8
Glycerin or Diethylene Glycol	6	Perfume Compound	To suit
Tincture Benzoin (6%)	8	Distilled Water [3]	72

[22] Ibid, p. 55.
[23] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[24] Ibid., p. 54.
[1] Bennett, Chem. Formulary, Vol. 5, p. 62 (1941).
[2] Ibid.
[3] Ibid.

BATH OIL

Sulphonated Oil	75	Diethylene Glycol	10
Perfume Oil	15		

Distilled water may be added if desired, although a highly concentrated bath oil is usually to be preferred.[4]

ALMOND OIL EMULSION

Almond Oil	81	Oleic Acid.	6
Triethanolamine Oleate	6	Water [5]	81

LANOLIN EMULSION

Diglycol Oleate (light)	10	Lanolin (Anhydrous)	30

Warm until dissolved. Add to the above with rapid agitation

Water	60

made slightly alkaline with caustic soda (¼%). Stir five to ten minutes.[6]

Cleansing Creams

Formula No. 1.

Lanolin	22	Distilled Water	42
White Mineral Oil	25	Perfume [1]	To suit
White Petroleum Jelly	11		

Formula No. 2.

1. Mineral Oil (White)	54.0	4. Borax	1.0
2. Beeswax	18.0	5. Water	21.0
3. Parachol	5.5	6. Perfume	0.5

Melt together 1, 2 and 3. Dissolve 4 in 5 and heat to boiling. Add this to first mixture, slowly, with stirring; add perfume before solidification begins.[2]

[4] Ibid.
[5] Ibid., Vol. 1, p. 153 (1933).
[6] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[1] Bennett, Chem. Formulary, Vol. 3, p. 66 (1936).
[2] Ibid., Vol. 1, p. 106 (1933).

FORMULA No. 3.

1. Mineral Oil	80	4. Water	90
2. Spermaceti	30	5. Glycerin	10
3. Glycosterin	24	6. Perfume to suit.	

Heat 1, 2 and 3 to 140°F. and stir into it, slowly, 4 and 5 heated to same temperature. Add perfume, at 105°F. stir slowly until cold after allowing to stand for 5 minutes. Stir until smooth and pack.[3]

FORMULA No. 4.

1. Mineral Oil	78	2. Perfume	1
White Wax	5	3. Glycerin	4
Spermaceti	28	Water	92
Trihydroxyethylamine Stearate (Special)	20		

Heat No. 1 and 3 separately to 200°F.; then add No. 1 to 2 slowly, stirring thoroughly. When the cream begins to set, the perfume is added and stirred in. Allow to stand over night. Stir thoroughly the next morning and package.[4]

FORMULA No. 5.

Stearic Acid	29	Triethanolamine	3.6
Lanolin (Anhydrous)	8	Carbitol	10
Mineral Oil (White)	50	Water	100

Melt the stearic acid in the mineral oil, add the lanolin and bring the temperature of this oil solution to 70°C. Then add it to the solution of triethanolamine and water which has been brought to the boiling point in a separate container. Stir vigorously to obtain a uniform emulsion and add the Carbitol solution of the perfume. Continue with even stirring until a smooth cream is obtained and then occasionally until cold. Too rapid stirring causes an undesirable aeration of the cream.[5]

[3] Ibid.
[4] Ibid., Vol. 2, p. 133 (1935).
[5] Ibid., Vol. 1, p. 10.

FORMULA No. 5A.

Ammonium Stearate (Paste)	250 oz.	Mineral Oil, White	25 oz.
		Perfume to suit.	

Stir until most of the ammonia has evaporated.[5a]

	Formula No. 6	Formula No. 7		Formula No. 6	Formula No. 7
Stearic Acid	8.0	8.0	Ceresin	2.0	...
Paraffin	7.0	...	Amino Glycol	3.0	3.0
Mineral Oil	30.0	35.0	Glycerin	...	5.0
Petrolatum	...	10.0	Water[6]	50.0	39.0

FORMULA No. 8.

Sorbitol Mono-Oleate	5	Mineral Oil	32
Sorbitol Di-Stearate	10	Lanolin	3
Beeswax	7	Water	43

This combination gives a moderately firm cream with a fine-grained texture.[8]

FORMULA No. 9.

U.S.P. Flaked White Beeswax	10	Water	40
Ceresin Wax (Melting Point 138°F.)	5	Borax	½
Mineral Oil (Viscosity 68/75)	65	Perfume	Sufficient

The beeswax, ceresin and a portion of the mineral oil are placed in a steam jacketed kettle and the temperature in melting the waxes should be at no time in excess of 80°C. The emulsifying power of beeswax is retarded or broken down when the temperature is too high.[9]

FORMULA No. 10.

Sorbitan Monostearate	12	Water	48
Olive Oil, Deodorised	40	Preservative[10]	q.s.

5a Bennett, Chem. Formulary, Vol. 1, p. 106 (1933).
6 Kalish, Drug & Cosmetic Industry, *48,* 36 (1941).
8 Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
9 Ibid., Vol. 11, p. 146 (1935).
10 Atlas Powder Co., Wilmington, Del.

FORMULA No. 11.

Lanette Wax SX	12	Sorbitol Syrup	5
Lanette Wax K	6	Water	65
Sorbitan Mono-Oleate	2	Preservative [11]	q.s.
Raisin-Seed Oil	10		

FORMULA No. 12.

Glyceryl Monostearate	14	Sorbitol Syrup	5
Liquid Paraffin	10	Water	69
Stearyl Alcohol	1	Preservative [12]	q.s.
Sorbitan Mono-Oleate	1		

FORMULA No. 13.

Liquid Paraffin	10.0	Sorbitan Mono-Oleate	2.0
Stearic Acid	3.3	Water	79.0
Isopropanolamine	1.7	Preservative [13]	q.s.
Sorbitan Monostearate	2.0		

FORMULA No. 14.

Sorbitol Mono-Oleate	1.0	Stearic Acid	1.0
Sorbitol Monostearate	1.0	Isopropanolamine	0.5
Sorbitol Syrup	1.0	Water	94.5
Stearyl Alcohol	1.0	Preservative [14]	q.s.

FORMULA No. 15.

Mannitan Monolaurate	10.0	Water	60.0
Olive Oil, Deodorized	30.0	Preservative [15]	q.s.

Cold Creams

FORMULA No. 1.

1. Diglycol Stearate	14 lb.	4. Petrolatum (White)	6 lb.
2. Paraffin Wax	2 lb.	5. Water	6 gal.
3. Mineral Oil	3¾ gal.	6. Perfume Oil	5½ fl. oz.

a Melt Nos. 1, 2, 3 and 4 at 170°F.

b Heat 5 to 180°F.

[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Ibid.
[15] Ibid.

c Add *b* to *a* while mixing. Allow mixer to run until batch is completely emulsified.

d Allow batch to cool to 125°F. and add 6 and mix at low speed.

e Batch should be allowed to cool without stirring to 105°F. at which temperature it is poured into jars.[1]

FORMULA No. 2.

Stearic Acid	15	Zinc Stearate	15
Butyl Stearate	5	Water[2]	63
Amino Glycol	2		

FORMULA No. 3.

Glyceryl Monostearate	8	Petrolatum	10
Magnesium Stearate	14	Mineral Oil, White	5
Beeswax	3	Water[3]	60

FORMULA No. 4.

A very low priced light bodied greaseless but stable cream is made as follows:

Glycosterin	22	2.	Water	128
Petrolatum, White	16		Borax	3
Paraffin Wax	12		Potassium Carbonate	2
Mineral Oil	32			

Heat above separately to 80°C. and pour (2) into (1) slowly while stirring. Add perfume at 55°C. stir and pack. If cold packed a high gloss is given to surface by passing a flame lightly over surface in each jar.[4]

FORMULA No. 5.

Cetyl Alcohol	100	Cholesterin	5
White Beeswax	150	Borax	10
Vegetable Oil	200	Water	260
Mineral Oil	250	Perfume[5]	25

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[1] Bennett, Chem. Formulary, Vol. 3, p. 65 (1936).
[2] Kalish, Drug & Cosmetic Industry, *48,* 36 (1941).
[3] Ibid., Vol. 3, p. 67 (1936).
[4] Ibid., Vol. 1, p. 108 (1933).
[5] Goldschmidt, U. S. 2,269,529 (1942).

FORMULA NO. 6.

Stearic Acid Esters of Polyethylene Glycol	10	Mineral Oil	15
Stearic Acid	10	Petrolatum	10
Paraffin Wax	15	Salt, such as Sodium Chloride	6
		Water,[5] To make	100

FORMULA NO. 7.

COSMETIC CREAMS

Stearyl Alcohol	1.0	Petroleum Jelly	45.0
Mannide Monooleate	3.5	Water[6]	45.5
Raisin Seed Oil	5.0		

FORMULA NO. 8.

Beeswax	540	Water	720
Spermaceti	300	Borax	100
Mineral Oil	1730	Sodium Benzoate	10
Stearin	430	Perfume.	

The fat bases should be melted with mineral oil. The borax and benzoate of soda is dissolved in water and brought to the boil and stirred while still hot into the molten fats. Allow to cool with slow agitation. Add perfume.[7]

FORMULA NO. 9.

a. Ceresin, White	27	Mineral Oil, White	87
Spermaceti	25	*b.* Borax	5
Stearic Acid	21	Water, Distilled	36
Undecylic Acid	1		

Melt *a* and add with agitation to the hot solution *b*. Stir until cold.[8]

FORMULA NO. 10.

Cetyl Alcohol	10	Vaseline, White	
Paraffin, Liquid	10	Water	60

Transparent, soft, white cream.[9]

[5] P. C.
[6] Kalish, Drug and Cosmetic Industry, *48*, 36 (1941).
[7] Bennett, Chem. Formulary, Vol. 1, p. 109 (1933).
[8] Ibid., Vol. 4, p. 48 (1939).
[9] Bennett, Chem. Formulary, Vol. 3, p. 65 (1936).

FORMULA NO. 11.

Mineral Oil	1 gal.	Water (preferably distilled)	½ gal.
White Beeswax	2 lb.	Powdered Borax (bolted)	2 oz.

Mix beeswax and oil in one container. Bring to 150°F. then reduce to 120°F. Dissolve borax in water. Bring to 120°F. Pour borax and water solution slowly into wax and oil solution stirring constantly but not rapidly. At 115°F., perfume and pour into containers.[10]

FORMULA NO. 12.

Stearic Acid	16	Stronger Ammonia Water	4
Glycerin	48	Water	64
Mineral Oil	12	Perfume[11]	
Paraffin Wax			

FORMULA NO.	13	14	15	16
Sorbitol Syrup	3.0	8.0	5.0	2.5
Potassium Carbonate	0.7		0.7	
Potassium Hydroxide		1.0		
Triethanolamine				1.7
Water	76.4	64.1	45.1	70.9
Preservative ("Moldex")	0.1	0.1	0.1	0.1
Stearic Acid	15.0	20.0	10.0	3.5
Lanolin	0.5	1.5	0.5	2.0
Mineral Oil	2.0	2.0	35.3	15.0
Mannitan Monoöleate	2.0	1.0	1.0	2.0
Mannitan Monostearate			2.0	2.0
Spermaceti		2.0		
Perfume[12]	0.4	0.4	0.4	0.4

FORMULA NO. 17.

Spermaceti	125	Borax	5
White Wax	120	Distilled Water	190
Liquid Petrolatum	560	Oil of Rose, Synthetic[13]	q.s.

[10] Ibid., Vol. 1, p. 109 (1933).
[11] Ibid., Vol. 3, p. 65 (1939).
[12] Atlas Powder Co., Wilmington, Del.
[13] Bennett, Chem. Formulary, Vol. 1, p. 108 (1933).

FORMULA No. 18.

Stearic Acid of Polyethylene Glycol	15	Aluminum Chloride, Hydrated Crystals	12
Spermaceti	5	Water [14]	To make 100
Glycerine	3		

FORMULA No. 19.

Zinc Sulphate	0.15	Sodium Benzoate	0.1
Alum	0.2	Cocoa Butter	3.0
Acacia (Powdered)	4.0	Perfume	0.5
White Beeswax	15.5	Distilled Water [15]	63.53
Glycerin	13.0		

FORMULA No.	20	21	FORMULA No.	20	21
Stearic Acid	8	8	Ceresin	2	
Paraffin	7		Amino Glycol	3	3
Mineral Oil	30	35	Glycerin		5
Petrolatum		10	Water [16]	50	39

FORMULA No. 22.

Stearic Acid	4.0	Amino Glycol	0.8
Cetyl Alcohol	1.0	Quince Seed	0.5
Butyl Stearate	3.0	Water [17]	90.7

FORMULA No. 23.

Stearic Acid	30	Triethanolamine	3.8
Lanolin (Anhydrous)	20	Carbitol	16
Beeswax (White)	16	Water [18]	95
Mineral Oil (White)	33		

FORMULA No. 24.

White Mineral Oil	73.5	Paraffin Wax	5.0
White Beeswax U.S.P.	16.5	Ozokerite	5.0

The above should be heated to a temperature slightly above its melting point. The proper type of perfume is then added.

In a separate container, 1½ pound borax is dissolved in water. The amount of water can vary from 26 to 36 pounds per 100 pounds of finished cold cream.

14 Goldschmidt, U. S. 2,269,529 (1942).
15 Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
16 Kalish, Drug and Cosmetic Industry, *48,* 36 (1941).
17 Ibid.
18 Bennett, Chem. Formulary, Vol. 1, p. 107 (1933).

The borax dissolved in the water and heated almost to the boiling point (approximately 200°F.) is then added all at one time to the above mixture. Stir during the addition of the borax water and continue stirring until a complete emulsion has been formed. The cream should be filled into the jars while still warm; not hot but just warm enough to pour easily so that it will have a perfectly smooth and even appearance at normal temperature.

Caution: If the water is not hot enough when added to the base, the cream will separate drops of water upon standing. If the stirring is not properly done or not continued long enough, the cream will likewise separate water.[19]

FORMULA No. 25.

White Mineral Oil	45.0	Spermaceti	6.0
White Beeswax U.S.P.	13.0		

Heat all together until liquid; then add under stirring

Powdered Borax	1.0	Water [20]	35.0

which has been heated previously to about 85°C.

FORMULA No. 26.

Apricot Kernel Oil	54	Ethyl Amino Benzoate	½
White Beeswax	13	Borax Powder	½
White Ceresin Wax	8½	Distilled Water	25

Melt apricot kernel oil, beeswax and ceresin wax together and add ethyl amino benzoate. Stir until dissolved. Adjust temperature to 65°C. Dissolve borax in hot distilled water and filter. Adjust temperature to 65°C. Then add borax solution slowly while stirring to the oil and wax mixture kept at the same temperature and stir until cold.[21]

[19] Ibid., Vol. 2, p. 147 (1935).
[20] Ibid.
[21] Ibid., Vol. 1, p. 109 (1933).

FORMULA No. 27.

Beeswax	15.0	Water	20.0
Petrolatum	14.0	Borax	0.5
Mineral Oil	50.0	Perfume	0.5

Melt wax and petrolatum. Add oil. Dissolve borax in hot water. Add to above with stirring.[22] Perfume at 120°F.

FORMULA No. 28.

a. Beeswax, White	60	*c.* Borax	5
Spermaceti	70	Benzoic Acid [23]	5
Stearic Acid	10	Water	220
b. Peanut Oil	620	*d.* Perfume	10

Melt *a*, and mix with *b*. Take to 55°C. on the waterbath, and add the hot solution *c* in small portions with good agitation. When properly emulsified and slightly cooled, add *c*. Stir until cold.

FORMULA No. 29.

Glycosterin	20	Mineral Oil	8
Paraffin Wax	30	Water	200
Petrolatum White	18	Perfume [24]	To Suit

FORMULA No. 30.

Spermaceti	125	Borax	5
White Wax	120	Water, Distilled [25]	190
Liquid Petrolatum	560		

FORMULA No. 31.

Stearic Acid	4	Glycerine	12
Paraffin Wax		Add Ammonia (26°)	½ oz.

When there is a perfect saponification, add 16 oz. warm distilled water in which must be dissolved 15 grams powdered borax.[26]

[22] Bennett, Chem. Formulary, Vol. 2, p. 147 (1935).
[23] Ibid., Vol. 4, p. 48 (1939).
[24] Ibid., Vol. 1, p. 108 (1933).
[25] Ibid., p. 109.
[26] Ibid.

FORMULA No. 32.

White Wax	10 oz.	Liquid Petrolatum	3 lb.
Paraffin	9 oz.	Borax	1 oz.
Ceresin	2 oz.	Water, Distilled [27]	pt., 4 fl. oz.
White Petrolatum	8 oz.		

FORMULA No. 33.

a. Beeswax, White	80	Benzoic Acid	5
Spermaceti	50	*c.* Perfume	9
Stearic Acid	20	*d.* "Apple Ether"	1
Lanolin, Anhydrous	20	*e.* Peanut Oil	540
b. Borax	5	*f.* Water	270

Melt *a,* mix in *e,* and saponify with *b* and *f.* Add *d* to cover the odor of the lanolin; perfume with *c.*[28]

FORMULA No. 34.

Hard Paraffin Wax	50	Lanolin, Anhydrous	60
Petrolatum, Yellow	400	Rosin, Pale	40
Peanut Oil	200	Water	140
Beeswax, Yellow	100	Borax [29]	10

FORMULA No. 35.

Parachol (Absorption Base)	125	Glycerin	200
Peanut Oil	400	Water [30]	800

FORMULA No. 36.

a. Woolfat, Anhydrous, Neutral	40	Peanut, Olive, or Sesame Oil	20
Petrolatum, White	10	*b.* Glycerin	5
		Water	25

Melt *a* on waterbath. Add *b.* Stir till cold.[31]

Perspiration Deodorizing Creams

FORMULA No. 1.

Beeswax	8 oz.	Benzoic Acid	20 gr.
Liquid Petrolatum	24 oz.	Salicylic Acid	400 gr.
Sodium Borate	100 gr.	Hot Water	16 oz.

[27] Ibid., Vol. 1, p. 108 (1933).
[28] Bennett, Chem. Formulary, Vol. 4, p. 48 (1939).
[29] Ibid., p. 49.
[30] Ibid., p. 56.
[31] Ibid., Vol. 4, p. 51 (1939).

Melt the wax and oil and heat to about 160 degrees F. Dissolve the other materials in the water, heat to the same temperatures as the wax solution, and pour it into the latter, beating briskly until the cream is formed. Here a comparatively high temperature of the solutions, plus a small amount of stirring, results in a glossy cream.[1]

FORMULA No. 2.

Mannide Mono-oleate	2	Water	40
Petrolatum	38	Hydrated Aluminium Chloride[2]	20

FORMULA No. 3.

Paraffin Wax	10	Petrolatum	5
Mineral Oil	10	Aluminum Sulphate	10
Deomul	15	Water	50

Heat waxes and oils to 70°C., add 30 parts water. Cool to 45°C., and stir in salt dissolved in 20 parts water.[3]

FORMULA No. 4.

Polymerized Glycol Stearate	15	Aluminum Chloride, Hydrated	
Spermaceti	5	Crystals	12
Glycerin	3	Water[4]	To make 100

FORMULA No. 5.

a. Mineral Oil	25	*c.* Oxyquinoline Sulphate	
Acimul	25	(0.1% Solution)	25
b. Water	25		

a is heated till clear. *b* is heated to 75°C. and added to *a* stirring thoroughly. At 60°C. add *c* and stir. It is necessary to add *c* in small portions taking care to make no more additions until the previous portions have been emulsified. Add perfume. Stir. Pour at 55°C.[5]

[1] Ibid., Vol. 1, p. 115 (1933).
[2] Atlas Powder Co., Wilmington, Del.
[3] Bennett, Chem. Formulary, Vol. 5, p. 58 (1941).
[4] Glyco Products Co., Inc., Brooklyn, N. Y.
[5] Bennett, Chem. Formulary, Vol. 4, p. 53 (1939).

DEPILATORY CREAM

a. Tragacanth, Gum	3.0	*b.* Isocholesterol	14.0
Glycerin	8.0	White Beeswax	4.0
Water	45.9	Mineral Oil (0.881)	25.0
Sodium Benzoate	0.1		

Disperse *a* in the usual manner. Cool to a medium warmth, add the mixture *b* in small portions. Homogenize.[6]

FRECKLE "PREVENTATIVE"

Quinine Bisulphate	20	Mineral Oil	100
Water	477	Woolfat	100
Amino Stearin	100	Perfume Oil	3
Petrolatum, White	200		

Melt the oils and waxes with agitation and add, at about 70°C., the quinine bisulphate solution of equal temperature. Stir until cold.[1]

ACID CREAMS

Formula No. 1.

Glycol Distearate, Pure	14.0	Citrus Pectin	0.5
Mineral Oil	3.0	Perfume	0.5
White Beeswax	2.0	Citric Acid	2.0
Ceresin	1.0	Glycerin	6.0
Lanolin	1.0	Distilled Water[2]	69.0
Sodium Lauryl Sulphate	1.0		

Formula No. 2.

Wool Wax	3.0	Glycerin	4.0
Lanolin	8.0	Lactic Acid	1.5
Stearyl Alcohol	2.0	Distilled Water[3]	44.5
Petrolatum	37.0		

HONEY AND ALMOND TYPE CREAM

Cold Cream	½ oz.	Solution of Soda, B.P.	1½ oz.
Almond Oil	½ oz.	Quince Mucilage	5 oz.
Honey	½ oz.	Water to make	5 pt.
Boric Acid	1 oz.		

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[6] Ibid., p. 61.
[1] Ibid., p. 56.
[2] Bennett, Chem. Formulary, Vol. 5, p. 59 (1941).
[3] Ibid.

Stir the cold cream, almond oil, and solution of soda together until a uniform soapy emulsion is obtained. Dissolve the boric acid in 60 ounces of warm water; to this add the glycerin and quince mucilage, and add the mixture slowly, and with constant stirring to the mortar contents. Perfume with spirits of almonds and rose when cold and make up.[4]

ALUM CREAM

Petrolatum, White	9.0	Carbitol	3.0
Paraffin Wax (52°C.)	6.5	Alum Solution, Saturated	5.5
Mineral Oil	14.0	Rose Water	50.0
Acimul	12.0		

Melt the oil and waxes at 70°C. Add them to water, alum solution and Carbitol of the same temperature with good stirring. Stir until cold enough to be just about pourable (50°C.). Perfume at 55°C.[7]

ASTRINGENT CREAMS

Formula No. 1.

Diglycol Stearate	10	Heat to 170°F.	
Lanolin Anhydrous	5	Tannic Acid	2
Mineral Oil	3	Water	70

Heat to 170°F. and add to above at that temperature with agitation.

Perfume as desired.[8]

Formula No. 2.

Paraffin	15	Mineral Oil	60
Lanolin	10	Cetyl Alcohol	15

Heat to 150°. Then add a heated solution of:

[4] Ibid., Vol. 2, p. 146 (1935).
[7] Bennett, Chem. Formulary, Vol. 4, p. 54 (1939).
[8] Ibid., Vol. 2, p. 148 (1935).

Alum	15	Water	280
Tannic Acid	15		

Agitate until the cream congeals.[9]

AVOCADO TISSUE CREAM

Avocado Oil	20	Almond Oil	25
Lanolin Absorption Base	10	Preservative	0.2
Stearic Acid	5	Perfume	0.8
Cetyl Alcohol	5	Borax	1
Beeswax	5	Distilled Water[10]	28

The water and borax are brought to a temperature of 165°F. and are then added to the molten fats, oils and waxes. Careful heating and constant stirring are essential, the perfume being added when the temperature has dropped to about 120°F.

AVOCADO OIL CLEANSING CREAM

Part 1.		Part 2.	
Hydrogenated Oil (Cosmetic Grade)	11.0	Distilled Water	15.3
Beeswax U.S.P., White	5.0	Borax U.S.P.	0.5
Stearic Acid, Triple Pressed	0.5	Part 3.	
Sesame Seed Oil	60.0	Perfume[11]	0.6
Avocado Oil	7.0		
Antioxidant & Preservative	0.1		

Procedure: Melt Part 1 at 80°C. Heat Part 2 to 75°C.

When Part 1 has cooled to 75°C. add Part 2 with constant stirring. Add Part 3 at 60°C. Pour between 55°–50°C.[11]

ALMOND CREAM, LIQUID

Sweet Almond Oil	1 lb.	Borax	2 lb.
Spermaceti	2 lb.	Quince Jelly	1 lb.
Beeswax	2 lb.	Alcohol	1 pt.
Castile Soap, Powdered	3 lb.	Water	4 pt.

Melt the spermaceti and wax together. Dissolve the soap and borax in hot water. Mix these together and add balance of ingredients. Stir and filter through cloth.[12]

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9 Ibid.
10 Ibid., Vol. 4, p. 50 (1939).
11 Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
12 Ibid., Vol. 1, p. 105 (1933).

BORO-GLYCERIN LANOLIN CREAM

a. Boric Acid	10 g.	b. Lanolin, Anhydrous	100 g.
Glycerin	40 g.	Vaseline, White	600 g.
Water	250 g.	Melt gently.	
Dissolve.		c. Rose Oil, Artificial	10 cc.
		or Eau de Cologne Oil [13]	20 cc.

PEROXIDE CREAM

a. Paraffin Wax	4	*b*. Hydrogen Peroxide (100 volume)	5
Mineral Oil	10	*c*. Water	60
Lanolin	6		
Acimul	15		

Heat *a* to 70°C. and stir till completely clear. Heat *c* to 70°C. and add *a* to *c* slowly, stirring in one direction only. At 55°C. add *b* and perfume. Stir and pour at 50°C.

If 5 parts of the water are replaced by 5 parts "Carbitol" the cream can be poured at 45°C.[14]

BLEACHING CREAM

a. Petrolatum (White)	9	*b*. Carbitol	3
Paraffin Wax	6.5	* Lemon Juice	5.5
Mineral Oil	14	Water	50
Acimul	12		

* Lemon juice can be replaced by citric and lactic acid, etc., in proportionate amounts.[15]

A is melted, *b* is mixed, heated to 70–75°C. and poured slowly into *a*, with stirring. Perfume is added at 55°C. Pour at 50°C.

CHOLESTEROL-LECITHIN CREAM

Formula No. 1.

Lanolin, Anhydrous	20	Cholesterol	6
Stearin	10	Lecithin	12
Cacao Butter	20	Water	80
White Wax	20	Sodium Benzoate	1.5
Sweet Almond Oil, Preserved with Nipagin	200	Borax	15
		Nipagin M [16] (Preservative)	0.8

13 Ibid., Vol. 2, p. 70 (1935).
14 Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).

15 Ibid., Vol. 1, p. 104 (1933).

FORMULA No. 2.

Lanolin, Anhydrous	30	Water	18
White Wax	50	Cholesterol	1.5
Spermaceti	10	Egg Lecithin[17]	0.5
Borax	2		

FORMULA No. 3.

1. Parachol	10	Mineral Oil	10
Parasterin	20	2. Water	25

Heat (1) in water, both, till melted, allow to cool to 45–47°C. Warm (2) to 45–47°C. and add in 7 or 8 different portions to (1), stirring vigorously, taking care not to add more water until previous portions are absorbed.[18]

FORMULA No. 4.

Lanolin (Anhydrous)	12	Cream Petrolatum (Short Fiber)	55.5
Water (Distilled)	12	Mineral Oil (White)	20
Lecithin	0.5	Perfume[19]	To suit

HORMONE CREAM

a. Petrolatum	15	Spermaceti	
Lanolin, Anhydrous	15	*b.* Hormone Oil	20
Absorption Base	10	*c.* Water or Rose Water	40
Olive Oil	5	*d.* Perfume	

Melt *a* on the waterbath. Cool to below 35°C., and add *b*—then emulsify with *c*. Perfume last.[20]

LEMON JUICE CREAM

Five parts of oxy-cholesterin and 95 parts of petrolatum are thoroughly mixed to form an absorption base. Twenty parts of petrolatum and three parts of beeswax are melted together, and 30 parts of the base are added with thorough stirring. Fifty parts of natural lemon juice are added to the

[17] Ibid.
[18] Ibid., p. 105.
[19] Bennett, Chem. Formulary, Vol. 3, p. 68 (1936).
[20] Ibid., Vol. 4, p. 53 (1939).

above mixture while still hot and stirring is continued until the mass is cool.[21]

LIME AND GLYCERIN CREAM

Almond or Peach Kernel Oil	35.00	Lemon Oil	1.25
Glycerin	1.50	Lime Water, To make [22]	80.00

LIQUID LIP MAKE-UP

a. Triethanolamine Oleate	15	Mineral Oil, White	40
Glycerin	10	Scarlet, Oil-Soluble	2.5
Water	10	*c.* Perfume (Eau de Cologne Oil, Rose, Fougère)	
b. Beeswax	10		

Emulsify by adding *b* to *a* at 50–60°C. Stir till cold, and add perfume.[23]

MASCARA

Glyceryl Monostearate	10	Beeswax	25
Triethanolamine	5	Gelatin	2
Stearic Acid	15	Water	13
White Petrolatum	20	Carbon Black	10

Make a solution of the gelatin in water, add the triethanolamine. Melt the wax, glyceryl monostearate, petrolatum and stearic acid, add the pigment and then the hot gelatin solution. Mill to get a uniform product.[24]

MOUSTACHE POMADE

Glycosterin	4	Beeswax	30
Gum Arabic	8	Diethylene Glycol	12
Water	31	Perfume to suit.	
Castile Soap	12		

Warm until wax has melted and mix vigorously until uniform.[25]

Ibid., Vol. 3, p. 70 (1936).
[22] Ibid., Vol. 5, p. 59 (1941).
Ibid., Vol. 4, p. 54 (1939).
Bennett, Chem. Formulary, Vol. 5, p. 63 (1941).
Ibid., Vol. 4, p. 66 (1939).

"NOURISHING" CREAMS

Formula No. 1.

Absorption Base	25	Preservative	1.3
Diglycol Stearate	15	Water	75
Olive Oil	15		

Melt absorption base, diglycol stearate, and olive oil, and add to water which has been heated to same temperature and contains preservative. Mix well and stir slowly till cool. Incorporate perfume and package.[1]

Formula No. 2.

Mineral Oil, White	35 cc.	Amino Stearin	8 g.
Beeswax	20 g.	Water	50 cc.

Warm together and mix vigorously until emulsified.[2]

Formula No. 3.

Glycosterin	12	Mineral Oil	12
Petrolatum	4	Water[3]	65
Lanolin	6		

Formula No. 4.

White Wax	600	Cacao Butter	400
Spermaceti	100	Sweet Almond Oil	
Stearin	500	(With preservative)	1800
Lanolin, Anhydrous	600	Cholesterol, Purest	120

After solution of the cholesterol has been effected, stir the following hot solution into the molten mass until pasty:

Sodium Benzoate	15	Water[4]	1700
Borax	100		

Formula No. 5.

Beeswax	7	Water	50
Spermaceti	8	Mineral Oil	15
Lanolin Absorption Base	20		

[1] Ibid., Vol. 2, p. 146 (1935).
[2] Glyco Products Co., Inc., Brooklyn, N. Y.
[3] Ibid., Vol. 1, p. 112 (1933).
[4] Bennett, Chem. Formulary, Vol. 1, p. 112 (1933).

Melt the waxes and add the mineral oil. Warm the absorption base to 40°C. and the water likewise; then slowly add the water with steady but not violent agitation. Then add the melted waxes which should be of the same temperature.[5]

FORMULA No. 6.

Lanolin absorption base 400, glycerin 50, arnica (1:10) 50, witch hazel extract 150, distilled water 347, perfume 3. Heat the absorption base until soft (35°C.) and incorporate water previously heated to the same temperature a little at a time. Finally add the other ingredients. All parts by weight.[6]

FORMULA No. 7.

Cetyl Alcohol	50	Arachis Oil	100
Lanolin	50	Mineral Oil	150
Cocoa Butter	50	Petrolatum, White	240
Cholesterin	10	Water	280
White Beeswax	50	Perfume[7]	20

FORMULA No. 8.

Soft Paraffin Containing 1% Oxycholesterol	746	Triethanolamine	9
		Rose Water	225
Stearic Acid	20	Perfume	To suit

This cream can be made by dissolving the stearic acid and oxycholesterol in the molten soft paraffin, bringing the temperature to about 70–75°C., adding the mixture of rose water all at once at the same temperature, stirring vigorously (the heat being maintained) until the mixture is quite homogeneous, transferring to a cold mortar, and whisking until cold.[8]

FORMULA No. 9.

Lanolin		Triethanolamine	5
Stearic Acid	15	Water	200

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5 Ibid., Vol. 2, p. 147 (1935).
6 Ibid., Vol. 4, p. 52 (1939).
7 Ibid.
8 Ibid., p. 53.

Weigh out the triethanolamine and stearic acid and add to the whole quantity of water. Heat the mixture in a kettle and, when the stearic acid is melted, stir to a creamy soap solution. Add the lanolin and continue heating without stirring until the lanolin is melted and the mixture is just below the boiling point.

At this point stir the mixture thoroughly until a thick creamy emulsion results. Continue stirring intermittently until the emulsion has cooled to room temperature.[9]

FORMULA No. 10.

1. Diglycol Stearate	14 lb.	7. Perfume Oil	5½ fl. oz
2. Mineral Oil	3¾ gal.	8. Solution Yellow Color Made by Dissolving Yellow Dye 2 drams in Mineral Oil 14 fl. oz.	8¼ fl. oz
3. Lanolin	6 lb.		
4. Petrolatum (White)	2 lb.		
5. Water	6 gal.		
6. Turtle Oil	5½ fl. oz.		

Method of manufacture:

a. Melt 1, 2, 3, 4, 6 and 8 at 170°F.

b. Heat 5 to 180°F.

c. Add *b* to *a* while mixing. Allow mixer to run until batch is completely emulsified.

d. Allow batch to cool to 125°F. and add 7, and mix at low speed.

e. Batch should be allowed to cool without stirring to 100° F. at which temperature it is poured.[10]

FORMULA No. 11.

White Wax	5 oz.	Water	10 oz.
Spermaceti	1 lb.	Benzyl Alcohol	1
Petrolatum (Light Amber)	1 lb.	Bitter Almond Oil	1
Mineral Oil	1½ pt.	Rose Geranium Oil	1½
Lanolin (Hydrous)	2 lb.	Bergamot Oil [11]	2
Borax	⅜ oz.		

[9] Bennett, Chem. Formulary, Vol. 1, p. 104.
[10] Ibid., Vol. 3, p. 70.
[11] Ibid., Vol. 1, p. 112.

FORMULA NO. 12.

1. Spermaceti	10 lb.	Almond Oil	30 lb.
Lanolin	20 lb.	2. Water	90 lb.
Glycosterin	46 lb.	Sodium Benzoate	¼ lb.
Olive Oil	20 lb.	3. Perfume	to suit

Heat (1) to 150°F. and run into it slowly with stirring (2) which has been heated to the same temperature. Add the perfume at about 105°F. and stir in. Pour at 95–100°F.[12]

FORMULA NO. 13.

Absorption Base	30	Water	55
Lanolin	5	Beeswax, White	10

Procedure: Melt the wax and lanolin, add the base and stir in the water (warm).

(Note: Consistency in the foregoing formulas can be adjusted by changing the wax content to suit.) [13]

FORMULA NO. 14.

Lanolin, Anhydrous	22	Beeswax, White	40
Spermaceti	22	Cocoa Butter, Odorless[14]	28

FORMULA NO. 15.

Almond Oil (With preservative)	390	Sodium Benzoate	5
Lecithin	50	Parahydroxybenzoic Acid	2
Borax	5	Water[15]	220

FORMULA NO. 16.

Trihydroxyethylamine Stearate	20	Carbitol	20
Turtle Oil	50	Water (Distilled)	300
Paraffin Oil (White)	40	Preservative	5
Diglycol Stearate	5	Perfume Oil	To Suit

Melt together the first four of these ingredients, and slowly add the water, which has been heated to 50°C., with

[12] Ibid.
[13] Bennett, Chem. Formulary, Vol. 1, p. 113 (1933).
[14] Ibid., p. 112.
[15] Ibid., p. 113.

constant stirring. Continue stirring until cool, and then add Carbitol, containing the perfume and preservative.[16]

FORMULA No. 17.

Part 1.		Part 2.	
Hydrogenated Oil	25.6	Water (Distilled)	15.8
Beeswax U.S.P.	9.7	Borax U.S.P.	0.5
Lanolin Anhydrous U.S.P.	8.5	Part 3.	
Spermaceti U.S.P.	2.5	Oleic Acid (White)	0.3
Sesame Seed Oil U.S.P.	36.5	Perfume	0.5
Preservative and Antioxidant	0.1		

Melt Part 1 at 70°C. Bring Part 2 to same temperature and add to Part 1 with slow agitation. Add Part 3 at above 60°C. Pour hot and top.[17]

FORMULA No. 18.

Ti-Tree Oil	10 g.	Glycerin	1 g.
Lanette Wax SX	10 g.	Water[18]	50 g.
Mineral Oil	29 g.		

PROTECTIVE HAND CREAMS

FORMULA No. 1.

Glyceryl Monostearate	8	Petrolatum	10
Magnesium Stearate	14	Mineral Oil	5
Beeswax	3	Water	60

Heat together to 70°C. and stir until cool.[19]

FORMULA No. 2.

Lanolin (Anhydrous)	20	Glycol Stearate	12
Paraffin Wax	6	Water	55
Paraffin Oil	7		

Melt lanolin, glycol stearate, and wax; add oil; then add water while agitating rapidly until cold.[20]

[16] P. C.
[17] Ibid., Vol. 4, p. 50 (1939).
[18] Ibid., Vol. 5, p. 59 (1941).
[19] Bennett, Chem. Formulary, Vol. 2, p. 146 (1935).
[20] Glyco Products Co., Inc., Brooklyn, N. Y.

MASSAGE CREAM

White Beeswax	20	Water	45
Spermaceti	20	Borax	3
Peanut Oil	45	Camphor	1
Lanolin	12		

Melt the wax over a water bath, add the lanolin and oil, and heat to 80°C. The camphor is dissolved in the oil with gentle heat, the borax is dissolved in the water and heated to 80°C. At this temperature the water is added to the wax oil mixture at the same temperature with vigorous stirring; best done with a motor stirrer.[21]

SPORTS CREAM

Glycosterin	12	Cetyl Alcohol	3
Mineral Oil	10	Water	100

Heat to 60°C. and mix vigorously till emulsified.[22]

NAIL CREAM

a. Beeswax, White	15.0	Borax	1.5
Ozokerite, White	2.5	*c.* Aluminum Stearate	20.0
Montan Wax, Bleached	2.5	*d.* Fish Silver Paste (10% Dispersed in Amyl Acetate)	5.0 g.
Mineral Oil	60.0		
Cetyl Alcohol	2.0		
b. Water	23.5		

Melt *a*, add *b* of about 70°C. Stir thoroughly, add *c*. Stir until the emulsion is almost cold, add *d*.[23]

MOSQUITO REPELLING CREAM

Formula No. 1.

a. Wheat Starch	5	*c.* Lanolin	30
Water	10	*d.* Clove Oil	5–10
b. Glycerin (28° Bé.)	45		

Grind *a* until homogeneous, add *b*, and warm gently until a homogeneous jelly is formed. Cool, and grind now with *c*

[21] Ibid., Vol. 2, p. 149 (1935).
[22] Ibid., Vol. 4, p. 53 (1939).
[23] Ibid., p. 67.

and *d* in a mortar very thoroughly until distribution is satisfactory. Fill at once into collapsible tubes.[1]

FORMULA No. 2.

Glyceryl Monostearate	11.0	Menthol	0.5
Oil of Cedar Leaf	4.0	Phenol	2.0
Oil of Pennyroyal	4.0	Glycerin	5.0
Linalyl Acetate	3.0	Water	65.5
Gasoline	5.0		

Put the glyceryl monostearate into the water, add the glycerin and bring the mixture to the boiling point with constant stirring. Keep stirring and when the temperature drops to about 45°C. add the rest of the ingredients which have been mixed together.[2]

FORMULA No. 3.

White Mineral Oil	16 oz.	Distilled Water	8 oz.
Beeswax U.S.P.	4 oz.	Borax	30 gr.
Spermaceti	1 oz.	Butyl Salicylate [3]	1.5 oz.

ANTISEPTIC CREAM

FORMULA No. 1.

Mixed Mono- and Di- Fatty Esters of Polythylene Glycol	10	Mineral Oil	15
Stearic Acid	10	Petrolatum	10
Paraffin Wax	15	Oxy-Quinoline Sulfate	0.2
		Water [4]	to make 100

FORMULA No. 2.

Sulphonated Castor Oil	150	Potassium Carbonate	50
Methyl Salicylate	150	Glycerin	100
Eucalyptol	45	Water [5]	500
Menthol	5		

ACRIFLAVINE EMULSION

Acriflavine	1 g.	Distilled Water	25 cc.
Wool Fat	50 g.	Liquid Paraffin	925 cc.

[1] Bennett, Chem. Formulary, Vol. 3, p. 68 (1936).
[2] Ibid., Vol. 2, p. 363 (1935).
[3] Ibid., Vol. 1, p. 111 (1933).
[4] Goldschmidt, U. S. 2,269,529 (1942).
[5] Bennett, Chem. Formulary, Vol. 2, p. 157 (1935).

Dissolve the acriflavine in the distilled water, heated to about 90°, and add the solution to the anhydrous lanolin in a large warmed mortar. Triturate until a thick cream is produced, then add gradually the liquid paraffin.[6]

WHITE OIL EMULSION

Agar	0.7	Sodium Benzoate	0.2
Gum Acacia	2.1	Flavoring	0.7
Tragacanth	0.3	Water[7]	46
White Mineral Oil	50.0		

SUN-BURN PREVENTIVE PREPARATIONS

Formula No. 1.

Quinine Sulphate	3	Lanolin, Anhydrous	15.0
White Ceresin Wax	5.5	Water	35.5
White Petrolatum	20.5	Cassia Oil	1.0
Mineral Oil	19.5		

Heat the water to 70°C. and dissolve the quinine sulphate in it. Melt the ceresin, petrolatum, and lanolin together, stir in the mineral oil, bring the mixture to 65°C. and stir in the quinine solution. Continue stirring until the temperature drops to 45°C. and then add the cassia oil.[1]

Formula No. 2.

Quinine Bisulphate	2.5	Alcohol	10.0
Cholesterin Absorption Base	25.5	Water	49.5
Mineral Oil	12.5	Perfume[2]	.5

Formula No. 3.

a. Triethanolamine	40	Trihydroxyethylamine Stearate	40

Melt on water bath, make emulsion in

Water (60°C.)	620–630	Peanut Oil	150
b. Paraffin Oil	100	Oleic Acid	30

[6] Ibid., p. 371.
[7] Ibid.
[1] Ibid., p. 150.
[2] Ibid.

Warm up on water bath to 40°C.

Methyl-*p*-Hydroxy Benzoate	1

Pour *b* into *a*, perfume with

c.	Perfume Oil	to suit

Stir until cold.[3]

SUNBURN HEALING PREPARATIONS

Formula No. 1. (Healing Oil)

Tincture of Benzoin		Olive Oil	40
Borax		Lime Water	52

Dissolve the borax in the lime water; add the olive oil with rapid agitation. When an emulsion is formed add the tincture of benzoin.[4]

HAIR CREAMS

Formula No. 1.

Cholesterin	2	White Mineral Oil	50
White Petrolatum	10	Water	100
Lanolin	10		

The lanolin may be replaced by deodorized arachis oil and beeswax (1:5). It is necessary to use a homogenizer in the preparation of such a cream.[1]

Formula No. 2.

Gum Tragacanth (pulv.)	1.5	Sodium Benzoate	0.2
Castor Oil	8.0	Formaldehyde	0.4
Glucose	8.0	Water to	160.0
Alcohol	14.0	Perfume[2]	Sufficient

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[3] Bennett, Chem. Formulary, Vol. 3, p. 98 (1936).
[4] Ibid., Vol. 2, p. 153 (1935).
[1] Ibid., Vol. 4, p. 66 (1939).
[2] Ibid., Vol. 2, p. 161 (1935).

FORMULA No. 3.

Gum Tragacanth (pulv.)	1.5	Formaldehyde	0.4
Castor Oil	4.0	Water to	160.0
Glycerin	8.0	Perfume	Sufficient
Alcohol	14.0	Mineral Oil [3]	48.0
Sodium Benzoate	0.2		

FORMULA No. 4.

Powdered Soap	50	Glycerin	18
Water	36		

Dissolve the soap in hot water, add the glycerin. While stirring well add

Peanut Oil	40

Mix until homogeneous and add

Perfume	12

and continue stirring until nearly cool. To get maximum stability run through a colloid mill.[4]

HAIR MILK

FORMULA No. 1.

Glyceryl Monostearate	6	Distilled Water	64
Liquid Paraffin	30	Perfume [5]	To suit

FORMULA No. 2.

1. Mineral Oil, White	144	3. Water, Warm	320
2. Trihydroxyethylamine Stearate	29	4. Perfume	3

While stirring heat (1) and (2) until melted together. Add (3) slowly with stirring until uniform. Add (4). Stir. Allow to stand overnight, stir moderately and package.[6]

[3] Ibid.
[4] Bennett, Chem. Formulary, Vol. 4, p. 66 (1939).
[5] Ibid., Vol. 4, p. 63.
[6] Ibid., Vol. 1, p. 147 (1933).

FORMULA NO. 3.

Triethanolamine Stearate	7	Distilled Water	65
Spermaceti	3	Perfume	to suit
Liquid Paraffin	25		

Dissolve the trihydroxyethylamine stearate and spermaceti in the liquid paraffin over a water-bath. While still warm run in the water previously warmed. Stir vigorously until quite homogeneous and cool, working in the perfume as the cream cools.[7]

MILKY HAIR WASH

1. Trihydroxyethylamine Stearate Special	10 lb.	3. Pine Oil	6 lb
2. Kerosene	150 lb.	4. Water	250 lb

Heat Nos. 1 and 2 to 140°F. and stir until dissolved; then stir in No. 3. Now allow No. 4 to run in slowly while stirring. If the pine oil is objectionable, however, any other oil may be substituted for it. It may be colored by means of any water-soluble dye free from salt.[8]

PINE TAR SHAMPOO

Pine Tar	25	Industrial Spirit	200
Yellow Soft Soap	300	Water[1]	475

SOAPLESS SHAMPOO

Sulfonated Olive Oil, concentrated	40	White Mineral Oil	15
Sulfonated Castor Oil, concentrated	10	Water	35
		25% Solution of Caustic Soda to Clear	

Mix all the ingredients with the exception of the caustic soda, warm to 45–50°C. and add enough of the caustic soda solution (1 or 2%) until the mixture turns bright. Perfume as desired.[2]

[7] Ibid., Vol. 4, p. 63 (1939).
[8] Ibid., Vol. 1, p. 119 (1933).
[1] Bennett, Chem. Formulary, Vol. 2, p. 159 (1935).
[2] Ibid., Vol. 1, p. 119 (1933).

HAIR TONIC

Cholesterol	10	Sodium Choleate	5
Mineral Oil	50	Glycerin	50
Heat to 130°F.			

Heat to 130° and add to above slowly with agitation. Then add slowly with agitation a solution of

Borax	5	Water	1000

That has been heated to 130°F. Stir until cold.[3]

PINE OIL EMULSIONS

Formula No. 1.

1. Pine Needle Oil	10	3. Water	5
2. Sodium Sulforicinoleate	10	4. Fluorescein	To Suit

Mix 1 and 2 until dissolved. Add 3 slowly with stirring. Add 4 and stir until dissolved.[1]

Formula No. 2.

Turkey Red Oil	10	Pine Oil	
Fluorescein		Water	

Dissolve the fluorescein in the turkey red oil; add the pine oil and when well mixed add the water, stirring until a uniform liquid results. Strain if necessary.[2]

Formula No. 3.

Cocoanut Oil (Saponification No. 257)	160.0	Pine Oil	40.0
Potassium Hydroxide (89%)	46.0	Water	754.0

Cocoanut oil of Ceylon Grade is heated to a temperature of 80°–85°C. The potassium hydroxide is then dissolved in a sufficient amount of the water to make a 15% to 20% solution. One-half the solution is then added to the cocoanut

[3] Ibid., Vol. 2, p. 163 (1935).
[1] Bennett, Chem. Formulary, Vol. 1, p. 102 (1933)
[2] Ibid., p. 101.

oil and stirred in slowly. The balance of water is then added followed by the balance of potassium hydroxide solution which is stirred in slowly. The temperature of the mix is then kept at 80°–85°C. for a period of from two to three hours with good agitation. After complete saponification, the solution is then cooled, chilled and filtered in this chilled state. The Pine Oil is then added by stirring in very slowly. A sufficient amount of water is then added to balance water loss during sustained heating to bring product to original weight.[3]

Mixed Oleic Acid Esters of Polyglycol	10	Diglycol Monooleate	7
Pine Oil	40	Oxalic Acid	2
		Water[3a]	41

SOLIDIFIED PERFUME (OILS)

Trihydroxyethyl Amine Linoleate	Orange or Other Oil
	Water

Add in above order stirring well.[4]

WATER SOLUBLE PERFUMES
(Jellified Perfumes)

1. Trihydroxyethylamine Linoleate #297	2. Perfume
	3. Water

Mix Nos. 1 and 2 together until uniform. Add No. 3 slowly with stirring until a jelly is formed. The water must be added VERY slowly, stirring thoroughly, but as soon as a turbidity appears no more water can be added. These jelly perfumes disperse in water to give a milky solution when concentrated and a slightly turbid solution when highly diluted. By incorporating medicinal ingredients, ointments, salves, etc., are made which are not sticky and wash off readily with water.[5]

[3] P. C.
[3a] Goldschmidt, U. S. 2,269,529 (1942).
[4] Bennett, Chem. Formulary, Vol. 1, p. 126 (1933).
[5] Ibid., p. 127.

FORMULA No. 3.

Glycosterin	10	Lanolin	2
Ethylene Glycol	10	Stearic Acid	34
Mineral Oil White	8	Glycerin [3]	2

FORMULA No. 4.

1. Mineral Oil	10	3. Water	50
2. Glycosterin	10		

Heat (1) and (2) to 150°F. and stir (3) into it heated to 150°F. slowly. A little perfume and menthol (if desired) is stirred in at 105°F. and stirring is continued until cold.[4]

FORMULA No. 5.

Stearic Acid	12	Soap Flakes	3
White Mineral Oil	12	Water [5]	72
Paraffin Wax	5		

FORMULA No. 6.

Stearic Acid	16.5	Triethanolamine	1.0
Lanolin	1.0	Water	72.5
Raisin Seed Oil	8.5	Perfume [6]	0.5

FORMULA No. 7.

Glyceryl Monostearate	6.5	Peanut Oil	4.0
Stearic Acid	6.5	Glycerin	10.0
Mineral Oil	4.0	Water [7]	69.0

SHAVING CREAMS

FORMULA No. 1.

Stearic Acid	25.0 g.	Sodium Hydroxide (42° Bé.)	2.5 g.
Coconut Oil	8.0 g.	Water	39.0 g.
Arlex	3.5 g.	Olive Oil	2.0 g.
Boric Acid	1.5 g.	Cetyl Alcohol	1.0 g.
Potassium Hydroxide (42° Bé.)	18.0 g.	Menthol Crystals	0.22 g.

In preparing this cream, the stearic acid and oils are mixed and heated to 212°F. At this point the alkali, likewise heated

[3] Bennett, Chem. Formulary, Vol. 1, p. 131 (1933).
[4] Ibid.
[5] Ibid., p. 129.
[6] Ibid., Vol. 4, p. 73 (1939).
[7] Ibid., Vol. 1, p. 129 (1933).

to the same temperature, is slowly added with stirring. The mixture is then held at 210°F. for 16 hours and stirred every 3 or 4 hours during this time. Next, the boric acid dissolved in half the water content is added at 212°F. and mixed. Finally, the remaining constituents mixed with water at 212°F. are added and the composition is stirred slowly while cooling.[1]

FORMULA No. 2.

Glyceryl Monostearate	6.5	Peanut Oil	4.0
Stearic Acid	6.5	Glycerin	10.0
Mineral Oil	4.0	Water [2]	69.0

DISINFECTANT EMULSIONS

FORMULA No. 1.

Sulphonated Castor Oil	100	Caustic Soda (36° Bé.)	51.2

Heat above at 80–100°C., then add

Rosin	104

Mix with heating until uniform and add

Tar Oils (200–320°C.)	775

Mix until dissolved and then add

Water [1]	To make 1000

FORMULA No. 2.

Cresol	35	Castor Oil Soap	20
Creosote	45	Water [2]	To Suit

FORMULA No. 3.

Rosin	17	Caustic Soda	2
Washed Cresote	71	Water [3]	2
Cresol	10		

[1] Atlas Powder Co., Wilmington, Del.
[2] Bennett, Chem. Formulary, Vol. 1, p. 129 (1933).
[1] Bennett, Chem. Formulary, Vol. 3, p. 103 (1936).
[2] Ibid., Vol. 1, p. 150 (1933).
[3] Ibid.

FORMULA NO. 4.

Cresol	50.0	Castor Oil Soap	0.5
Cresote	7.5	Caustic Soda	0.1
Glue	2.5	Water [4]	60.0

FORMULA NO. 5.

Cresol	50 cc.	Potassium Hydroxide	4.2 g.
Linseed Oil	17 g.	Distilled Water, To	100 cc.
Oleic Acid	1 g.		

The oil and acid are heated to the maximum temperature of the water-bath and a solution of the potassium hydroxide in 25 mils. of water, heated nearly to boiling, is added.[5]

FORMULA NO. 6.

A very satisfactory water-soluble disinfectant is a mixture of equal parts of cresol and Turkey red oil.[6]

FORMULA NO. 7.

Cresylic Acid	100	Caustic Potash Solution	
Linseed Oil	100	(33⅓%)	75
		Alcohol [7]	6

FORMULA NO. 8.

Tar Oil Acids	40	Caustic Potash Solution	
Rosin	10	(33⅓%)	70
		Alcohol [8]	70

FORMULA NO. 9.

Cresylic Acid or Cresol	50	Sodium or Potassium Hydroxide	1
Sulfonated Castor Oil (50%)	24	Water	18
Red Oil or Oleic Acid	7		

Mix the red oil and cresol warm. Dissolve the hydroxide in the water, warming if necessary. Mix these two solutions and add the sulfonated castor.[9]

[4] Ibid.
[5] Ibid., Vol. 2, p. 273 (1935).
[6] Ibid., Vol. 4, p. 91 (1939).
[7] Ibid.
[8] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[9] Ibid., Vol. 2, p. 273 (1935).

FORMULA No. 10.

Tar Acid Oil	66.00	Caustic Soda (25% Solution)	10.30
Rosin	20.00	Water[10]	3.70

FORMULA No. 11.

Light Coal Tar Oil (Sp. Gr. about 1.02 at 60°F.)	69.4	Caustic Soda Solution (Sp. Gr. 1.3)	9.6
Rosin (Grade F)	18.4	Water	2.6

This formula is stated in percentages by weight.

Melt rosin and add oil, mix well. Add soda and mix. Add water.[11]

FORMULA No. 12.

Tar Acids	75	Mineral Oil	4
Oil Soluble Mineral Oil Sulphonate	11	Isopropyl Alcohol[12]	10

PINE OIL DISINFECTANT

FORMULA No. 1.

Pine Oil	60	Sulphonated Castor Oil[1]	15
Naphthenic Soap	25		

FORMULA No. 2.

Pine Oil	57.00	Glucose	1.00
Rosin	25.00	Water	8.50
Caustic Potash (25% Solution)	8.50		

The caustic potash and water are mixed and heated. When boiling the rosin is added slowly and the heating is continued for one hour taking care to stir mixture occasionally, then the pine oil is added and the heating is continued until a sample that has been withdrawn and poured into water does not show separation of oil. When the test is satisfactory the heat is removed and the glucose is added.

For use add one ounce to gallon of water.[2]

[10] Ibid.
[11] Ibid.
[12] Schuler, U. S. 2,228,407 (1941).
[1] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[2] Ibid., Vol. 2, p. 273 (1935).

FORMULA No. 3.

Pine Oil	63 lb.	Water[3]	8 lb.
Soap	29 lb.		

FORMULA No. 4.

Raw Pine Oil	60	Red Oil or Oleic Acid	9
Sulfonated Castor Oil (50%)	30	Potassium Hydroxide (Solid)	1

Mix the pine oil and the sulfonated castor together. Then add the red oil and dissolve the potassium hydroxide in the mixed oils.[4]

FORMULA No. 5.

Rosin Soap	10 lb.	Pine Oil	60 lb.

The pine oil is worked into the soap gradually, to avoid lumping. Part of the pine oil may be replaced by kerosene to lower costs. The above when stirred into water gives a milky white emulsion.[5]

FORMULA No. 6.

Phenol	1 oz.	Sulphonated Olive Oil (30%)	16 oz.
Pine Oil	5 oz.	Water[6]	78 oz.

FORMULA No. 7.

Oleic Acid (Acid Number 194)	61.6	Sodium Hydroxide (100%)	16.3
"I" Wood Rosin (Acid Number 165)	61.6	Yarmor Pine Oil	133.0
		Tri-sodium Phosphate	26.7
		Water[7]	700.8

ANTISEPTIC EMULSION

FORMULA No. 1.

Oil Soluble Mineral Oil Sulphonate	11	Eucalyptol	5
Thymol	5	Isopropyl Alcohol	20
		Kerosene[8]	59

[3] Ibid., Vol. 4, p. 91 (1939).
[4] Ibid., Vol. 2, p. 273 (1935).
[5] Ibid., Vol. 1, p. 150 (1933).
[6] Ibid., Vol. 4, p. 92 (1939).
[7] Hercules Powder Co., Wilmington, Del.
[8] Schuler, U. S. 2,228,407 (1941).

FORMULA No. 2.

Cetyl Alcohol	68	Mineral Oil	91
Medicinal Soap	18	Water	780
Glycerin	23	Perfume [9]	20

[9] Bennett, Chem. Formulary, Vol. 4, p. 59 (1939).

CHAPTER VII

DEFOAMING AGENTS

Defoaming

Octyl alcohol is used as a defoaming agent as follows (all suggested concentrations are by volume unless otherwise indicated):

(a) Oil, where foaming is due to presence of water, use 0.0005%.
(b) Varnish inks, use 0.001–0.01%.
(c) Beet sugar, use 0.0005–0.005% of solution.
(d) Paper, use 0.0005–0.005% of pulp.
(e) Analytical procedure; such as analyses of fruit juices, powdered milk, petroleum-water mixtures, etc., use a few drops in 500 cc.
(f) Photographic film developing solutions. Spray 1 to 10 oz. for 200 gal. of foam.
(g) Textile printing, use 0.25–1.5% of paste.
(h) Chemical Processes (manufacture dyes, alum, etc.) use .1–1.0%.
(i) Wire drawing soap lubricants, use 0.01–0.1%.
(j) Asphalt emulsions, use 0.001–0.01%.
(k) Eliminating air bubbles and "pin holes" in gelatin glue spreading, use 0.1–1.0%.

Where the odor of octyl alcohol is objectionable the proprietary de-foamer "Foamex" is used similarly to the above.[1]

[1] Bennett, Chem. Formulary, Vol. 4, p. 100 (1939).

DEFOAMING AND DEFROTHING AGENTS

Formula No. 1.

5 parts of aluminum stearate is dissolved in 95 parts of pine oil, to give a substantially clear fluid solution.[1a]

Formula No. 2.

5 parts of aluminum stearate is dissolved in a mixture of 78.75 parts of pine or eucalyptus oil and 26.25 parts of a mixture of higher alcohols obtainable as a by-product during the manufacture of methanol.

The addition of one per cent or less of either of the above to a solution of 10 parts of glue and 10 parts of dextrine in 100 parts of water completely prevents the development of foam or froth when the mixture is shaken.[2]

Formula No. 3.

5 parts by weight of aluminum stearate is dissolved in 95 parts of the fraction boiling from 195°C. and up of the liquid oxygen-containing organic compounds obtainable as a by-product in the known synthesis of methanol under pressure from hydrogen and oxide of carbon.

The addition of 1 per cent or less of the above solution to a solution consisting of 20% of animal glue in water completely prevents the development of foam or froth when the mixture is shaken.[3]

Formula No. 4.

5 parts of zinc stearate is dissolved in 95 parts of pine oil at 95–100°C.[4]

[1a] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).
[2] Ibid.
[3] Ibid.
[4] Ibid.

Formula No. 5.

3 parts of calcium oleate is dissolved in 97 parts of pine oil at 95–100° C.[4a]

The addition of 0.25% of either of the above two agents to a solution of 10 parts of glue and 10 parts of dextrine in 100 parts of water considerably reduces the amount of foam formed when the mixture is shaken as compared with the amount normally formed.[5]

When 0.25% of pine oil alone is added, the amount of froth formed is also sensibly reduced but still remains about double that formed according to the above process.

Formula No. 6.

5 parts of barium stearate is dissolved in 95 parts of oleic acid at 95–100° C.

The addition of ¼% of this agent to glue-dextrine solutions reduces the froth formed on shaking to half the amount formed when ¼% of oleic acid alone has been added.[6]

RADIATOR ANTI-FOAMING AGENT

Water	1000	Potassium Hydroxide [7]	12
Montan Wax	8		

[4a] Ibid.
[5] Ibid.
[6] Ibid.
[7] Flaxman, U. S. 2,127,490 (1938).

CHAPTER VIII

FOOD EMULSIONS

BUTTERSCOTCH ICING

Boil to 245°F.

Brown Sugar	8 lb.	Water	4 pt.
Butter	4 lb.	Salt	2 oz.

Now cream up lightly

Powdered Sugar	25 lb.	Liquid Skimmed Milk	2 pt.
Shortening	5 lb.		

Into this creamed mass add the hot butterscotch syrup and whip up to the desired consistency [1]

CHOCOLATE MILK, STABILIZED

Sodium Alginate	0.8 lb.	Cocoa	8.8 lb.
Irish Moss	0.7 lb.	Milk [8]	96.0 gal.
Sugar	44.0 lb.		

COCOA ICING

Beat together until smooth and glossy:

Plastic Cocoanut Butter	16	Icing Sugar	88
Invert Sugar	20	Milk Powder	4¾
Water	12	Salt	⅛
Cocoa	20	Vanilla [2]	

[1] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[2] Bennett, Chem. Formulary, Vol. 1, p. 54 (1933).

ARTIFICIAL CREAM

Formula No. 1.

Butter, unsalted	2 lb.	Sugar	oz.
Milk	2 pt.	Sodium Alginate	oz.

Warm the milk and butter together to 100°F., add the sugar and alginate and stir thoroughly until dissolved. Homogenize without the addition of further heat and without allowing the mixture to cool. If the cream is to be kept for any length of time the mixture should be pasteurized at 140°F. for half an hour before homogenizing and then passed through a sterilized homogenizer.[3]

Formula No. 2.

Butter Fat	19.00	Gelatin	1.00
Vegetable Fat	10.00	Borax	0.25
Milk Powder	7.00	Water	62.00
Sugar	0.75	Flavor [4]	To suit

Formula No. 3.

To produce a 32% fat synthetic shipping cream, use 1 lb. 10 oz. of emulsifying type shortening, 2 lb. 15 oz. water, 8 oz. dry milk solids and not over 1½% fat.

To produce a half and half cream made from half uncultured butter and half emulsifying type shortening, use 1 lb. 14 oz. uncultured butter, 1 lb. 10 oz. emulsifying type shortening, 1 lb. dry milk solids not over 1½% fat, 5 lb. 9 oz. fresh water.[5]

SYNTHETIC "CREAM" FOR CONFECTIONERY

As an example, a whale oil is used which has been hydrogenated until its melting point is about 30°C. (86°F.) A

[3] Ibid., Vol. 4, p. 131 (1939).
[4] Ibid., Vol. 1, p. 57 (1933).
[5] Ibid., Vol. 5, p. 145 (1941).

blend is made from 10 lb. of this hardened fat, 5 lb. of buttermilk, 1.5 lb. sugar and 12 oz. of glycerin. The resulting emulsion is stirred thoroughly while passing in air, to form a creamy product.[6]

CHEESE, ICE-CREAM AND SALAD STABILIZER

Locust Bean Gum	65	Karaya Gum	15
Irish Moss, Powdered	35		

When used in the preparation of cream cheese, the undiluted mixture of the three ingredients mentioned above is added at the time that the curds are mixed with the cream in the usual procedure for the manufacture of cream cheese and in the proportion of about one-half of 1% by weight on a wet basis. The material is heated to about 165°F., homogenized, and then packed hot.

In ice cream it is used diluted with sugar, in the preferred proportion of one-half of 1% on a wet basis, the stabilizer acts to prevent crystallization of ice particles and thus insures a fine, smooth texture and a body which will hold up under severe shocks.[7]

DAIRY PRODUCT AND STABILIZER

Select Irish Moss (Pulverized)	20 lb.	Glyceryl Mono Stearate	9 lb.
Ordinary Irish Moss (Pulverized)	20 lb.	Tri Sodium Phósphate	8 oz.

The process of making the stabilizer is as follows:

The two grades of Irish moss, the glyceryl mono stearate, and the tri-sodium phosphate with the addition of 10 times their weight of water are heated in a mixing kettle. Preferably, the heating is done by direct steam injection which adds to the moisture content and also serves as an agitator to

[6] Ibid., p. 145–6.
[7] Ibid., Vol. 3, p. 150 (1936).
[8] Green, U. S. 2,097,225 (1937).

insure complete admixture of the ingredients. The temperature is brought to the boiling point and held at that degree for approximately 30 minutes during which time the steam circulates through the batch, the odor of the Irish moss being carried off in the escaping steam.

The batch is then pumped to an atmospheric double drum drier or its equivalent, and all but approximately 1% to 6% of its moisture content is removed. Where a drier of the type described is employed, the moisture is, of course, removed by the heated rolls. The material comes off the drier in flake form, and it is then pulverized which makes it ready to be incorporated in the dairy powder from which the chocolate milk and other dairy products are made.[9]

INFANTS' MILK SYNTHETIC

Sugar	40	Dextrin	20
Soya Bean Powder	125	Egg Yolk, Liquid	50
Lactose	30	Calcium Lactate	6
Peanut Oil	20	Salt	2

Stir in water before use.[10]

LEMON OIL EMULSIONS

FORMULA No. 1.

Gum Tragacanth	18 oz.	Water	4 gal.

Place the gum tragacanth in a kettle similar to a baker's mixing machine. Pour the water over it, stir well and whip until all the lumps have disappeared. Let stand overnight.

Next morning squeeze the gum solution through a cheesecloth bag. Add to the homogeneous gum solution

Glycerin	1 qt.

Place the kettle under the machine and allow to mix for 5 minutes at slow speed.

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[9] Bennett, Chem. Formulary, Vol. 5, p. 146 (1941).
[10] Bennett, Chem. Formulary, Vol. 3, p. 151 (1936).

Now put the machine in second speed and gradually add

Lemon Oil	4 qt.

After 1 quart of oil has been added, it is advisable to put the machine in third speed, as, otherwise, the oil will not be taken up by the gum solution. When all the oil has been added, stop the machine, scrape the walls of the kettle with a long-bladed spatula and add 5 ounces of benzoate of soda in solution, to prevent fermentation. Start the machine again in third speed for about 5–10 minutes.[1]

FORMULA No. 2.

1. Gum Arabic	13 oz.	3. Lemon Oil	20 oz.
2. Terpeneless Oil of Lemon	20 oz.	4. Glycerin	40 oz.
		5. Water	To make 10 gal.

Mix 1 and 4, then mix in 2 and 3 to this; add 5 slowly with good stirring. Beat intermittently until homogeneous. Then pass through an homogenizer.[2]

TRANSPARENT LEMON OIL EMULSION

Invert Sugar Syrum (80%)	60 lb.	Water	16 lb.
Medium Fine Granulated Sugar	24 lb.	Gelatin (180 Bloom-Min.)	4 oz.

The gelatin is dissolved in water, corn syrup added and the mixture heated until solution is complete. The invert syrup is then added and the whole thoroughly mixed. The refractive index of this solution should be approximately 1.4720. In the preparation of the emulsion, 20 ounces of terpeneless and 20 ounces of regular lemon oil are mixed with enough of the above solution to produce 10 gallons. This mixture is then homogenized and left standing for 18 hours which allows entrapped air bubbles to rise to the surface. Glass containers are filled from the bottom outlet of

[1] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[2] Ibid.

the emulsion container and tightly stoppered. The resultant emulsion will be practically transparent.[3]

ORANGE OIL EMULSION

Gelatin	4 oz.	Invert Sugar	60 lb.
Water	16 lb.	Terpeneless Orange Oil	20 oz.
Cane Sugar	24 lb.	Orange Oil	20 oz.

Dissolve the gelatin in the water, add the cane sugar and heat until dissolved. Then add the invert sugar and mix well; homogenize.[4]

ORANGE EMULSION (CLOUDY)

Gum Arabic (Best Grade)	1 lb.	Water	1 pt.

Let stand overnight; mix and filter. Add

Orange Oil	6 dr.

Mix and pass through a colloid mill. Use ½ oz. of above per gallon of syrup.[5]

BITTER ALMOND OIL EMULSION

Gum Arabic	10	Cane Sugar	
Bitter Almond Oil	2	Water	120

Mix together the sugar and gum. Then add it to the water, which is agitated by means of a rapid mixer, then allow to mix until a uniform emulsion results. Then add the oil slowly until completely emulsified.[6]

MARGARINE

FORMULA No. 1.

1. Glycerol Monostearate	85 lb.	3. Cotton Seed Oil, Winterized	125 lb.
2. Coconut Oil (76°F. Titer)	800 lb.	4. Cultured Milk	50–55 gal.

[3] Bennett, Chem. Formulary, Vol. 5, p. 119 (1939).
[4] Handbook of Food Mfg., Fiene and Blumenthal.
[5] Bennett, Chem. Formulary, Vol. 4, p. 45 (1939).
[6] P. C.

Melt 1, 2 and 3 and mix; churn with milk, temper, work and salt.[1]

FORMULA No. 2.

Soya Bean Lecithin (60–65%)	100 lb.	Glyceryl Distearate	100 lb.

Melt together and mix in

Water Hot	100 lb.

Add and mix in

Water Warm	500 lb.

One lb. of above is added to 100 lb. plastic margarine.[2]

FORMULA No. 3.

1. Water	120	4. Caustic Soda	0.02
2. Galagum C	1	5. Butter Flavor	To suit
3. Cottonseed Oil	40		

Dissolve 4 in 1 and strew 2 on surface; bring to a boil while stirring; run 3 and 5 into it slowly with high speed intermittent stirring.[3]

MAYONNAISE AND SALAD DRESSINGS

MAYONNAISE

FORMULA No. 1.

Frozen Egg Yolk	120 lb.	Spice Mixture *	
Winter Oil (Cottonseed)	330 lb.	Salt	200 lb.
Spice Mixtures *	24 lb.	Mustard (Ground) #1	100 lb.
Vinegar **	160 lb.		

* Refer to government definitions and standards for food products.
** Vinegar: Use cider vinegar. Dilute 9 gallons of vinegar with 1 gallon of water.

Mix the frozen yolk, which must be taken out of the refrigerator the night before making the batch, with a part of the vinegar and the spices. Be sure to keep some vinegar back

[1] Bennett, Chem. Formulary, Vol. 5, p. 146 (1941).
[2] Ibid.
[3] Ibid., Vol. 1, p. 47 (1933).

to be added last or if the batch breaks. Allow the oil to flow in slowly.[1]

Formula No. 2.

Thicker than Formula No. 1. Milder in taste.

Frozen Egg Yolk	7½ lb.	Spice Mixture (As in Formula #1)	2 lb.
Winter Oil (Cottonseed Oil)	33 lb.	Vinegar (As in Formula #1)[2]	10 lb.

Formula No. 3.

Cotton Seed Salad Oil	70.25 lb.	Salt	1.45 lb.
Egg Yolk	10.00 lb.	Sugar	3.50 lb.
Vinegar (50 grain)	10.00 lb.	Mustard	.80 lb.
Water	3.90 lb.	White Pepper	.10 lb.

The egg yolk can be reduced to 7.5 lbs. The sugar can be left out.[3]

Formula No. 4.

Frozen Egg Yolk	4½ lb.	Mustard #2	8 oz.
Winter Pressed Cottonseed Oil	75 lb.	White Vinegar	1 qt.
Salt	13 oz.	Water[4]	2 qt.

Formula No. 5.

Egg Yolk (Fresh)	12 lb.	Paprika	¾ oz.
Sugar	2½ lb.	Pepper (White)	¾ oz.
Mustard Flour	1 lb.	Oil (Salad)	13 gal.
Salt	1 lb. 7 oz.	Vinegar (100 grain, white)	4 qt.
Onion Juice (Fresh)	2 oz.	Water	2 qt.

The yolks are thrown into the beater bowl. Set the beater at high speed. Beat the yolks until they are well broken up which requires about a minute.

[1] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[2] Ibid.
[3] Ibid.
[4] Ibid.

Next, add sugar, mustard flour, salt, paprika and pepper, and beat until creamed. This will require from 2 to 5 minutes, depending on the per cent of egg white that adheres to the yolks. The more whites, the longer the time required and also the less desirable.

Now start the oil slowly at first, and then add at the rate of 1 gal. per minute, until 9 gals. have been added.

The beater is then run on slow speed while 1 qt. of vinegar and 1 qt. of water are added and thoroughly mixed in.

Now run beater on high speed and slowly add remainder of oil at the rate of 1 gal. every 2 minutes. Shift beater to slow speed, and then add the remainder of the vinegar and water.

Shut off beater. Scrape down sides of bowl. At slow speed, mix entire batch for 2 minutes longer. Long beating of the entire mix tends to make the mayonnaise thinner.[5]

FORMULA NO. 6. (Modified)

Salad Oil	20	lb.	Mustard	2½	oz.
Egg Yolk	2	lb.	Concentrated Lemon Juice	3	oz.
100-Grade Pectin (Citrus)	1½	oz.	Water	14	oz.
Sugar	4¾	oz.	Vinegar[6]	20	oz.
Salt	4¾	oz.			

MAYONNAISE

FORMULA NO. 7.

Egg Yolks	14	lb.	Salt		lb.
Vinegar	10	lb.	Sugar	½	
Cotton Seed Oil (Prime Summer Yellow)	70	lb.	Mustard	¾	
			Pepper[7]	¼	

Mix thoroughly in mixing bowls and run through a colloid mill with a clearance of .005″.

[5] Bennett, Chem. Formulary, Vol. 5, p. 147 (1941).
[6] Ibid.
[7] Ibid., Vol. 4, p. 133 (1939).

SALAD DRESSINGS

Formula No. 1.

Cornstarch	5	Salt	5
Water	90	Sugar	10
Cottonseed Oil	51	Vinegar (White)	42
French Mustard	25		

Mix the cornstarch with a little cold water and add to the remaining hot water. Stir and boil until it stiffens, set aside to cool. Put the mustard into a bowl and gradually add the oil, stirring all the time. Next add sugar, salt, vinegar and then the cooled-down cornstarch.[1]

Formula No. 2.

Tapioca Starch	7	Salt	2
Water	30	Cane Sugar	4
Corn or Cottonseed Oil	40	Vinegar (White 5%)[2]	17

Formula No. 3.

Whole Eggs	9	Cerelose (Corn Sugar)	2.4 lb.
Mazola (Corn Oil)	12 pt.	Salt	9.6 oz.
No. 2 Buffalo Starch	2.4 lb.	Mustard	9.6 oz.
Water	2 gal.	Paprika[3]	0.96 oz.
Vinegar	7 pt.		

Formula No. 4.

Whole Eggs	11	Cerelose	2.4 lb.
Mazola	16 pt.	Salt	9.6 lb.
No. 2 Buffalo Starch	1.8 lb.	Mustard	9.6 lb.
Water	11 pt.	Red Pepper[4]	0.96 oz.
Vinegar	7 pt.		

WHITE OR CREAM SAUCE

Butter	3 tbsp.	Water	½ cup
Gum Karaya	2 tbsp.	Salt and Pepper	To taste
Heavy Cream	½ cup		

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[1] Handbook of Food Mfg., Fiene and Blumenthal.
[2] Handbook of Food Mfg., Fiene and Blumenthal.
[3] Crowley, Money Making Formulas.
[4] Crowley, Money Making Formulas.

Heat butter and mix with water and cream. When heated gradually sift in the gum karaya, beating or stirring until the gum is dissolved and season. Serve hot. If thin sauce is desired, use only 1 tablespoonful of gum.[5]

[5] Fiene and Blumenthal, Handbook of Food Manufacture.

CHAPTER IX

GASOLINE EMULSIONS

Formula No. 1.

Triethanolamine	1½	Butanol	5
Water	1	Gasoline	45
Oleic Acid	1½		

Dissolve triethanolamine in water and add the mixture of other ingredients slowly while stirring vigorously.*

Formula No. 2.

Triethanolamine	1	Butanol	5
Water	1	Gasoline	45
Oleic Acid	1		

Formula No. 3.

Triethanolamine	½	Butanol	5
Water	1	Gasoline	45
Oleic Acid	½		

Formula No. 4.

Triethanolamine	½	Butanol	5
Oleic Acid	1	Gasoline	45
Water	1		

Formula No. 5.

Triethanolamine	1	Butanol	2
Water	1	Alcohol	4
Oleic Acid	1		

* The stability of the above emulsions is improved considerably if they are passed through a colloid mill.

FORMULA No. 6.

Triethanolamine	1	Butanol	4
Water	1	Alcohol	2
Oleic Acid	1		

FORMULA No. 7.

Triethanolamine	1	Butanol	5
Water	1	Kerosene	20
Oleic Acid	1	Gasoline	25

FORMULA No. 8.

Triethanolamine	1	Alcohol	3
Water	1	Gasoline	45
Oleic Acid	1		

FORMULA No. 9.

Triethanolamine	1	Alcohol	3
Water	1	Gasoline	45
Stearic Acid	5		

FORMULA No. 10.

Triethanolamine	1	Alcohol	3
Water	1	Gasoline	45
Stearic Acid	3		

FORMULA No. 11.

Triethanolamine	1	Alcohol	3
Water	1	Gasoline	45
Stearic Acid	2		

FORMULA No. 12.

Triethanolamine	1	Alcohol	2
Water	1	Gasoline	45
Stearic Acid	3		

FORMULA No. 13.

Triethanolamine	½	Alcohol	3
Water	1	Gasoline	45
Stearic Acid	3		

FORMULA No. 14.

Triethanolamine	¼	Alcohol	3
Water	½	Gasoline	45
Stearic Acid			

Formula No. 15.

Triethanolamine	¼	Alcohol	2
Water	½	Gasoline	45
Stearic Acid	2		

Formula No. 16.

1% Water

Triethanolamine	175	Alcohol	1400
Water	350	Gasoline	31500
Stearic Acid	1400		

Formula No. 17.

¾% Water

Triethanolamine	175	Alcohol	1400
Water	260	Gasoline	31500
Stearic Acid	1400		

Formula No. 18.

½% Water

Triethanolamine	175	Alcohol	1400
Water	175	Gasoline	31500
Stearic Acid	1400		

Formula No. 19.

¼% Water

Triethanolamine	175	Alcohol	1400
Water	85	Gasoline	31500
Stearic Acid	1400		

Formula No. 20.

10% Water

Trihydroxyethylamine		Butanol	5600
Laurate	3500	Water	3500
Gasoline	31500	Triethanolamine	1750

Formula No. 21.

5% Water

Trihydroxyethylamine		Butanol	3500
Laurate	2100	Water	1750
Gasoline	31500	Triethanolamine	1050

FORMULA NO. 22.

1% Water

Trihydroxyethylamine Linoleate	2100	Butanol	3500
Gasoline	31500	Water	700
		Triethanolamine	1050

FORMULA NO. 23.

Gasoline	70.0	Water	20.3
Alcohol	9.0	Bentonite [23]	0.7

FORMULA NO. 24.

Gasoline	80.0	Bentonite [24]	0.7
Water	19.3		

ANTI-KNOCK FUEL

Triethanolamine	18	Sec. Hexyl Alcohol	25
Oleic Acid	58	Water	75
Butyl Cellusolve	20	Gasoline [25]	750

SOLIDIFIED GASOLINE

FORMULA NO. 1.

Coconut Oil	50 g.	Water	120 cc.
Caustic Soda Solution (10%)	46 cc.	Benzol	60 cc.
		Gasoline	5 gal.

Mix the coconut oil, caustic solution, alcohol, and 20 cubic centimeters of the water, and heat over a Bunsen burner until completely saponified. Then add the remaining 100 cubic centimeters of the water and stir out. Add to this the benzol and stir until completely emulsified. Then add the gasoline in small portions while stirring vigorously with a mechanical stirrer. The resulting jelly-like mass forms a very stable emulsion.[26]

[1-22] Inclusive: Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[23] P. C.
[24] P. C.
[25] Bennett, Chem. Formulary, Vol. 5, p. 603 (1941).
[26] Ibid., Vol. 2, p. 237 (1935).

FORMULA No. 2.

Stearic Acid	35	Alcohol	500
Caustic Soda (30%)	7	Gasoline [27]	4500

FORMULA No. 3.

Gasoline	0.5 gal.	Water	1.0 pt.
White Soap (Fine Shaved)	12 oz.	Household Ammonia	5 oz.

Heat the water, add soap, mix and when cool add the ammonia. Then work in slowly the gasoline to form semi-solid mass.[28]

FORMULA No. 4.

SOUND ABSORBING COMPOSITION

Exfoliated mica is used with the following binder:

Casein	25 lb.	Caustic Soda (15%)	10 lb.
Water	32 lb.	Alum	2½ lb.

After the casein has swelled and mixed until smooth, run in slowly with good mixing

Water	57½ lb.	Gasoline	57½ lb.

Put into forms and allow to dry.

[27] Klinkenstein, U. S. 1,848,568 (1932).
[28] Bennett, Chem. Formulary, Vol. 4, p. 15 (1939).

CHAPTER X

LACQUER EMULSIONS

COMBINATIONS of a lacquer with an emulsifying mixture results in some degree of emulsification and can be realized by any customary method. Most useful concentration ratio is 2½ lacquer to 1 of water phase.

Stability generally varies with particle size—all other variables being constant.

Poorest emulsions are made by rapid stirring with a high speed mixer. They are greatly improved by a stator-rotor type sheering action, of a colloid mill. The most stable emulsions are usually produced by high pressure extrusion, i.e., in an homogenizer. For easily dispersed systems, an homogenizer alone is sufficient. More difficulty dispersable systems must be predispersed by other types of equipment (colloid mill) before passing through homogenizer.

An emulsion with many large aglomerate particles can in general be expected to have a short life. The dispersed droplets should be small and uniform.

Almost any good emulsifying agent, and this includes soap, will form some type of an emulsion with a lacquer. Useful stabilities and this means three months or better, can only be realized by a careful selection of the emulsifier. One of the best found contains 0.5% Dupanol, 1.0% sulfonated

castor oil either alone or mixed with other emulsifiers or lacquer solvents.

Lacquers rich in resins are more easily dispersed than those that are nitro-cellulose rich, and as a rule have a longer life (Table A No. 2 and 5).

Lacquer emulsions have high flash points and are usually broken by freezing. Lacquers of very high viscosity are difficult to disperse.

NITROCELLULOSE EMULSIONS

TABLE A

LACQUER BASE FORMULAE (CLEAR)

Formula No.	1	2	3	4	5
Nitro Cellulose (Dry Weight)	30	25	30	30	40.0
Castor Oil	30	..	..	..	...
Triethyl Citrate	..	20	..	..	5.0
Tricresyl Phosphate	..	..	12	..	...
Dibutyl Phthalate	..	..	..	13	...
Resin (Alkyd)	..	10	15	15	...
Butyl Acetate	25	25	25	22	30.0
Xylene	..	5	..	..	7.5
Butanol	15	15	18	20	17.5

FORMULA No. 6.

Pigmented Nitrocellulose (Dry Weight)	20	Xylene	14.4
Resin (Alkyd)	8	Octyl Acetate	10
Castor Oil (Blown)	6	Butyl Acetate	25
Diamyl Phthalate	6	Alcohol (Present in nitro cellulose)	8.6
Carbon Black	2		

Table A

Any of these formulae can be emulsified without much difficulty using any of the emulsifiers of Table B. The difference lies in the properties of the dried films.

They are all formulated electrolyte free—small amounts can be included and dispersed. The presence of gelatin or

casein in the water phase will help disperse a certain concentration of electrolytes.

LACQUER EMULSIFIERS

Table B

Formula No. 1.

Duponol	0.5%	Water	98.5
Sulfonated Castor Oil	1.0		

Formula No. 2.

Duponol	0.5%	Acetone	10.0
Sulfonated Castor Oil	1.0	Water	88.5

Formula No. 3.

Duponol	0.5%	Casein	0.5
Sulfonated Castor Oil	1.0	Water	98.0

Formula No. 4.

Duponol	0.5%	Gelatin	2.0
Sulfonated Castor Oil	1.0	Water	96.5

Formula No. 5.

Duponol	0.5%	Acetone	10.0
Sulfonated Castor Oil	1.0	Water	88.0
Casein	0.5		

Formula No. 6.

Sodium Oleate	6%	Water	94

Formula No. 7.

Duponol	0.5%	Methyl Cellulose	0.3
Sulfonated Castor Oil	1.0	Water	98.2

Illustrates many of the various possible combinations of emulsifiers.

1. The emulsion stability varies with the composition of the lacquer phase. The presence of resins in lacquer usually

aids the dispersion, both as to the ease of forming the emulsion and the uniformity of droplet size.

2. The presence of acetone gives (1) increased emulsifying power for n/c rich lacquers, (2) depresses freezing temperature of the emulsion, (3) acetone replaced by a water miscible high boiling solvent decreases the tendency of film blush.

3, 4, 5, 8 are all of the same general type, i.e., they contain an auxiliary emulsifier or stabilizer. This additional material helps produce emulsions from lacquers of very high viscosity and those that are relatively rich in n/c.

6. While the stability of the emulsion using this emulsifying mixture may be satisfactory, too high a concentration of the emulsifiers that are incompatible with the lacquer results in a decrease of gloss upon the surface of the dried films.

7. Will produce a W/O emulsion. If the concentration is decreased to get a O/W emulsion a poor emulsion results (only partially emulsified).

Lacquer emulsions with casein emulsions are O/W; gelatin emulsions are W/O, 0.03% is the upper limit of methyl cellulose that can be included without producing "flatting" of the film. Methyl cellulose is an exceptionally good emulsifying aid.[1]

FORMULA No. 7a.

Lacquer Phase		Water Phase	
Nitrocellulose, (15–20 seconds viscosity, butanol dehydrated)	19.3	Water	86.5
Butanol	4.0	Acetone	10.0
Petrex #5	8.0	Duponol ME	0.5
Dibutylphthalate	10.8	Sulfonated Castor Oil	1.0
Titanox A	13.5	Casein	1.0
Butyl Acetate	12.3	Borax (5% Solution)[7]	1.0
Pent Acetate	12.3		
Toluol	19.8		

[7] Hercules Powder Co., Wilmington, Del.

Formula No. 8.

Lacquer Phase		Water Phase	
Nitrocellulose (5–6 seconds viscosity, butanol dehydrated)	28.6	Duponol ME (Dry)	0.5
Dibutylphthalate	8.0	Sulfonated Castor Oil	1.0
Castor Oil AA	2.0	Methyl Cellulose	0.3
Carbon Black	2.0	Acetone	10.0
Octyl Acetate	11.5	Water [8]	88.2
Sec. Hexyl Acetate	11.5		
Hexone	11.5		
Xylol	24.9		

Formula No. 9.

Lacquer Phase		Water Phase	
Nitrocellulose, 15–20 seconds viscosity, butanol, dehydrated	21.4	Duponol, ME	0.5
Titanium Dioxide	4.0	Sulfonated Castor Oil	1.0
Chrome Yellow	4.0	Casein	1.0
Dibutylphthalate	8.0	Borax (5% solution)	1.0
Petrex 5	10.0	Acetone	10.0
Sec. Hexyl Acetate	16.4	Water [9]	86.5
Pent Acetate	3.6		
Hexone	7.3		
Xylol	11.8		
Toluol	11.0		
Butanol	2.5		

Formula No. 10.

Lacquer Phase		Water Phase	
RS ½" N.C. (Dry wt.)	24.0	Duponol ME (dry)	0.5
Glyptal 2471 (Solid)	12.0	Sulfonated Castor Oil	1.0
Tricresyl Phosphate	14.0	Acetone	10.0
Butanol carried by N.C.	10.3	Water [10]	88.5
Toluol	14.7		
Butyl Acetate	12.5		
Hexone	12.5		

Formula No. 11.

The solids content of the lacquer base can be increased to 60 per cent in special formulations by using low-viscosity

[8] Ibid.
[9] Ibid.
[10] Ibid.

type nitrocellulose, a solvent plasticizer, and an exceptionally good solvent mixture. This allows a 1 :1 ration of solvent to water. The formulation below is a typical example of such a composition.

Lacquer Phase		Water Phase	
RS ½" N.C. (Dry wt.)	30.0	Duponol ME (Dry)	0.5
Glyptal 2471 (Solid)	13.0	Sulfonated Castor Oil	1.0
Dibutyl Phthalate	17.0	Acetone	10.0
Butanol carried by N.C.	12.9	Water [11]	88.5
Toluol	13.0		
Secondary Hexyl Acet.	7.0		
Hexone	7.1		

Formula No. 12.

Lacquer Phase		Water Phase	
RS 5–6" N.C. (Dry Wt.)	21	Duponol ME (dry)	0.5
Glyptal 2471 (Solid)	8	Sulfonated Castor Oil	1
Tricresyl Phosphate	12	Acetone	10
Butanol carried by N.C.	9	Water [12]	88
Toluol	12		
Xylol	12		
Hexyl Acetate	12		
Hexone	12		

Formula No. 13.

Lacquer Phase		Water Phase	
R.S. 15–20" N.C. (Dry wt.)	18.0	Duponol ME (Dry)	0.5
Ester Gum	9.0	Sulfonated Castor Oil	1.0
Dibutyl Phthalate	8.0	Acetone	10.0
Butanol carried by N.C.	7.8	Water [13]	88.5
Toluol	27.2		
Butyl Acetate	15.0		
Hexone	15.0		

BLACK PIGMENTED LACQUER EMULSION

Lacquer Phase		Water Phase	
R.S. ½" sec. (Dry weight)	20.0	Water	98.50
Dammar Gum (Dewaxed) (Dry Weight)	6.0	Duponol M.E. (dry)	0.25
		Sulphonated Castor Oil	1.25
Dibutyl Phthalate	3.0		
Tricresyl Phosphate	2.6		

[11] Ibid.
[12] Ibid.
[13] Ibid.

Lacquer Phase	
Blown Castor Oil	5.4
Carbon Black	2.0
Butanol carried by Nitro-cellulose	8.6
Butanol	5.0
Denatured Ethyl Alcohol (in Dammar Solution)	4.0
Hi-Flash Solvent Naphtha	13.8
Toluol (in Dammar solution)	2.0
Secondary Hexyl Acetate	13.8
Octyl Acetate	13.8

Ratio of lacquer phase to water phase recommended: From 2.5 to 1, to 3 to 1 parts by weight.[14]

GRAY PIGMENTED LACQUER EMULSION

Lacquer Phase	
R.S. ½ sec. (Dry weight)	18.0
Dammar Gum (Dewaxed) (Dry weight)	5.4
Tricresyl Phosphate	3.0
Blown Castor Oil	6.0
Gray Pigment *	12.0
Butanol carried by Nitro-cellulose	7.8
Butanol	1.9
Denatured Ethyl Alcohol (in Dammar Solution)	4.0
Hi-Flash Solvent Naphtha	14.0
Toluol (in Dammar solution)	2.0
Secondary Hexyl Acetate	13.0
Octyl Acetate	12.9

Water Phase	
Water	98.20
Duponol M.E. (dry)	0.25
Sulphonated Castor Oil	1.25
Methyl Cellulose	0.30

Ratio of lacquer phase to water phase recommended: From 2 to 1, to 2.5 to 1 parts by weight.[15]

* COMPOSITION OF GRAY PIGMENT

Zinc Oxide	96.0 oz.
Chrome Yellow	1.6 oz.
Carbon Black	0.7 oz.
Prussian Blue	0.7 oz.
Iron Oxide	1.0 oz.

[14] Bennett, Chem. Formulary, Vol. 4, p. 97–98 (1939).
[15] Ibid.

CHAPTER XI

LEATHER TREATMENT EMULSIONS

FAT LIQUORS

Formula No. 1.

Paraffin Oil	60 lb.	Borax	2 lb.
Sulphonated Cod Oil	40 lb.	Water (at 140°F.)[1]	20 gal.

Formula No. 2.

Fig Soap	20 lb.	Sulphonated Cod Oil	20 lb.
Water	30 gal.	Paraffin Oil	30 lb.
Waterless Moellon	30 gal.	Water,[2] To	50 gal.

Formula No. 3.

Soap	1½	Soda	¼
Neatsfoot Oil	1½	Water[3]	97

Formula No. 4.

Sulphonated Cod Oil	2 lb.	Soap	6 lb.
Stock Solution made as below	2 lb.	Bicarbonate of Soda	3 lb.
Cod Oil	50 lb.	Water[4]	5500 lb.
Degras	50 lb.		

Formula No. 5.

Sulphonated Neatsfoot Oil	20–40 lb.	Spindle Oil	10–20 lb.
		Neatsfoot Oil	100–80 lb.

[1] Bennett, Chem. Formulary, Vol. 2, p. 288 (1935).
[2] Ibid., Vol. 2, p. 289 (1935).
[3] Ibid., Vol. 4, p. 159 (1939).
[4] Ibid.

	No. 6	No. 7	No. 8
Sulfonated Neatsfoot Oil	30	20	25 lb.
Neatsfoot Oil	40	40	30 lb.
Mineral Oil	20	20	20 lb.
Soap	10	20	25 lb.

5% emulsions of the above are used at pH of 6.5–8.0.[5]

FORMULA NO. 9.

Water (150°F.)	1 gal.	Light Specific Gravity Mineral Oil	2 lb.
Sulphonated Cod Oil	2 lb.	Tallow Soap, Dissolved in 1 Gal. Water[6]	1 lb.
Raw Cod Oil	1 lb.		

FORMULA NO. 10.

Cold Test (20°) Neatsfoot Oil	50 gal.	Water	25 gal.
Paraffin Oil (28°)	25 gal.	Sulphonated Castor Oil (50%)[7]	25 lb.

Mix water first with the sulphonated castor oil. Then mix all ingredients at 30°C.

LEATHER DRESSINGS

FORMULA NO. 1.

Tallow	70.0	Beeswax	9.0
Petroleum Jelly	3.5	Rosin	2.0
Diglycol Stearate	13.0	Water[8]	2.0

FORMULA NO. 2.

Linseed Oil	6	Water Glass (40–45° Bé.)	4

Mix until emulsified. Apply with brush.[9]

Water	15 gal.	Methylated Spirits	1 qt.
Castor Oil	5 qt.	Benzol	1 qt.
Casein Solution	4 qt.	Lactic Acid[10]	½ pt.

[5] Ibid., p. 190.
[6] Ibid., p. 157.
[7] Ibid., Vol. 3, p. 200 (1936).
[8] P. C.
[9] Ibid., Vol. 1, p. 424 (1933).
[10] Ibid., p.

LEATHER FINISHES AND POLISHES

Formula No. 1.

Beeswax	5	Ammonia	1
Grey Fatty Carnauba Wax	1	Water	100
Olive Oil Bar Soap	5	Glycerin	1

The soap is dissolved in about 50 hot water and the ammonia added. The wax mixture is melted separately and added with stirring to the soap solution. The temperature of the soap solution must be well above the setting point of the wax, preferably about 90°C. When the emulsion is satisfactorily made the remainder of the water and the glycerin can be added and the mixture cooled down. A mixture of beeswax and carnauba is used here because the beeswax alone is too soft and sticky, while the carnauba alone would present difficulties in emulsification. Such a mixture is suitable for application to shoe calf and gives a soft brush-polished finish.[1]

Formula No. 2.

Castile Soap	15 lb.	Candeililla Wax	5 lb.
Carnauba Wax (No. 1 Yellow)	5 lb.		

Dissolve the soap in 8 gallons of water by boiling for one hour, adding water as it is lost by evaporation, then add melted wax and continue boiling for two more hours, then add water enough to make a total of 10 gallons. Strain the mass through 4 layers of cheese cloth.[2]

Formula No. 3.

Gray Fatty Carnauba Wax	20 lb.	Water	16 gal.
Turpentine	10 lb.	Turkey Red Oil (50%)	20 gal.
Olive Oil Soap	10 lb.		

The carnauba wax and turpentine are melted in a steam jacketed mixing pan. The soap, previously dissolved in the

[1, 3, 4] Davidsohn-Davidsohn, Shoe Finishes & Polishing Waxes.
[2] Bennett, Chem. Formulary, Vol. 4, p. 178 (1939).

hot water, is added with constant stirring and the mixture boiled for ten minutes, when the steam can be turned off and the Turkey red oil added. The hot liquid is run through a water-cooled colloid mill which cools and emulsifies it at the same time. A modification of the above mixing makes use of glue as a stabilizing colloid for the soap-wax emulsion and may be prepared in a similar manner.[3]

FORMULA No. 4.

Grey Fatty Carnauba Wax	20 lb.	Water	16 gal.
Turpentine	10 lb.	Rabbit Skin Glue	40 lb.
Olive Oil Soap	10 lb.	Water [4]	16 gal.

SHOEMAKERS' WAX BURNISHING POLISH

Carnauba Wax	10.0	Iron Chloride or Acetate	3.0
Turpentine	10.0	Acetic Acid (10%)	2.0
Duponol WA Paste	10.0	Water	65.0

Melt the wax and turpentine together and pour into a solution of the DUPONOL in 45 parts of the water at 95–100°C. Stir vigorously until a smooth emulsion is formed and then stir gently until the emulsion has cooled to approximately 35°C. At this point add a solution containing the iron salt and acetic acid, dissolved in the remaining 20 parts of water. Continue stirring slowly. The viscosity of the emulsion will be at first greatly increased after which it will return to its initial value; the resulting emulsion is a smooth, fluid paste [5]

FORMULA No. 5.

Shellac Wax	3	Carbon Tetrachloride	20
Montan Wax	3	Water	20
Carnauba Wax	3	Soda	3
Paraffin Wax	2	Castor Oil	1
Japan Wax	1	Naphtha	5
Varnish, Acetone	1	Turpentine Substitute	40
Lacquer, Nitrocellulose	1	Bornyl Acetate	1
Lacquer, Acetate	1	Shellac [6]	1

[5] E. I. du Pont de Nemours Co., Wilmington, Del.
[6] Veith, Brit. 425,323 (1935).

EDGE FILLER FOR SHOE FACTORY USE

Soap	15 lb.	Gelatine	11½ lb.
Yellow Dextrin	5½ lb.	Formaldehyde	1 qt.
Neatsfoot Oil	1½ qt.	Water	1 qt.
Oil of Mirbane	1 pt.		

This is made up with sufficient water to make 60 gal. solution.[7]

[7] Bennett, Chem. Formulary, Vol. 3, p. 205 (1936).

CHAPTER XII

LUBRICANT EMULSIONS

LUBRICANT GREASE

Formula No. 1.

White

a. Stearic Acid	10	b. Lime Hydrate	
Paraffin Oil, white	30	Water	2
		c. Paraffin Oil, White	56

Melt *a*, saponify hot with *b*; add *c* in small portions. Keep stirring until cold.[1]

Formula No. 2.

Yellow

a. Train Oil Fatty Acid	16	b. Lime Hydrate	
Mineral Oil, Pale	30	Water	2
		c. Mineral Oil, Pale	48

Prepare same as above.[1]

Formula No. 3.

Green Petrolatum	250 lb.	Fat	55 lb.
Paraffin Pale Oil (28° Bé.)	92 gal.	Water	3 gal.
Lime	9 lb.		

[1] Bennettt, Chem. Formulary, Vol. 4, p. 192 (1939).
[1a] Ibid.

Melt the petrolatum in the mineral oil. Mix well, then proceed as for ordinary calcium soap grease.[2]

Train Oil Fatty Acid	12	Spindle Oil	82
Lime, Hydrated	2	Water[3]	2
Zinc Oxide	2		

"COLD ROLLER GREASE BRIQUETS"

Formula No. 1.

Crude Woolfat	15	Cylinder Oil (7 E. at 100°C.)	78
Stearin from Woolfat	5	Caustic Soda (40° Bé.)[3a]	6

Formula No. 2.

Tallow	20	Cylinder Oil (7 E. at 100°C.)[4]	77
Caustic Soda (40° Bé.)	8.5		

HORSE-SHOE GREASE

Formula No. 1.

Woolfat, Neutral	5.2	Paraffin Wax	0.3
Spindle Oil	2.0	Water[1]	About 2.4
Soft Tar	0.5		

MIXED BASE GREASE

Lime	17 lb.	Aluminum Oleate (Pulp Stock)	50 lb.
Fat	113 lb.	Water	6 gal.
Pale Oil (100 Viscosity)	112 gal.		

Place the fat in a steam jacketed kettle equipped with paddles for stirring, add a small portion of the mineral oil, mix the lime with sufficient water to form a thin paste and add this to the material in the kettle. Turn on the steam and start the paddles. When the soap has cooked for 5 hours it should be tested to determine if saponification is completed, if so the steam is turned off and half of the balance of the

[2] P. C.
[3] Ibid., Vol. 3, p. 213 (1936).
[3a] Ibid., Vol. 4, p. 195 (1939).
[4] Ibid.
[1] Bennett, Chem. Formulary, Vol. 4, p. 203 (1939).

mineral oil is run in slowly. The rest of the mineral oil is run into a separate kettle and the aluminum oleate melted in it and this mixture is pumped into the first kettle while still warm. Stirring should be continued until a smooth uniform grease is produced.[2]

SOAP BASE LUBRICATING EMULSION

Cottonseed Oil	3 kg.	Caustic Soda	132 g.
Mineral Oil	1–2 kg.		

Heat to 180°C. until foaming stops. Add 13 kg. mineral oil in successive portions at intervals with stirring bringing up to 190–210°C. Pour into wooden tubs and cool to 70°C. Add 9 kg. water with stirring.[3]

VISCOUS EMULSION LUBRICANT

Heavy Mineral Oil	10	Water	40
Diglycol Stearate	10		

Heat together to 60°C. and stir until cold. A heavy cream results. The color is dependent on the color of the oil used.[4]

WATER IN OIL EMULSION LUBRICANT

50 grams of a heavy paraffin oil is mixed with 1 g. of n-lauryl-l-sulphuric acid and stirred with 0.25 g. of lead acetate dissolved in 48.75 g. of water. The resulting emulsion is a heavy grease and has good lubricating properties and may readily be extended with oil.[5]

GRAPHITE LUBRICANT

Degras (Free from Fatty Acids)	20	Turpentine	8.7
Kerosene	16	Ammonia (28%)	4.4
Water	75	Graphite Powder [6]	30

[2] Ibid., Vol. 3, p. 209 (1936).
[3] Ibid., p. 111.
[4] Ibid., Vol. 2, p. 302 (1935).
[5] Ibid., Vol. 4, p. 210 (1939).
[6] Ibid., Vol. 3, p. 213 (1936).

CHAPTER XIII

MEDICINAL EMULSIONS

BURN OINTMENTS

Formula No. 1.

Lanolin	30	Cycloform	10
Olive Oil	25	Water[1]	25
Spermaceti	10		

Formula No. 2.

Glyceryl Monomyristate	10.0	Cycloform	10.0
Butyl Myristate	10.0	Betanaphthol	2.5
Olive Oil	7.5	Water[2]	50.0
Alcohol	10.0		

COD LIVER OIL EMULSION

Formula No. 1.

Cod Liver Oil	26 oz.	Calcium Hypophosphite	½ oz.
Water	44 oz.	Sodium Hypophosphite	½ oz.
Tragacanth	50 g.	Saccharine[1a]	.001 oz.
Glycerin	5 oz.		

Formula No. 2.

a. Cod Liver Oil	420	c. Calcium Hypophosphite	12
Gum Arabic	15	Sugar	90
Gum Tragacanth	7½	Water	60
b. Gelatin	1	Water	86
Water	299		

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[1] Colloid Chem. Labs., Jersey City, N. J.

[2] Ibid.

[1a] Bennett, Chem. Formulary, Vol. 1, p. 379 (1933).

Make up *a* by grinding, and *b* by heating. Add *b* to *a* at once and stir until cooled.

To the cooled emulsion add the cooled solution *c* slowly, with good agitation.[2]

FORMULA NO. 3.

	Gum Arabic	100	Calcium Hypophosphite	50
	Gum Tragacanth	100–120	Sodium Hypophosphite	50
	Glycerin	1200	Water	4000
b.	Cod Liver Oil, Crude	3700		

Grind *a* until smooth, add *b* in small portions, homogenizing every time. To this add *c* in an emulsifying machine.[3]

FORMULA NO. 4.

Gum Arabic	12	Cod Liver Oil	300
Gum Tragacanth	16	Spice Oil Mixture	10
Glycerin (28° Bé.)	140	Calcium Hypophosphite	8
Distilled Water	430	Sodium Hypophosphite	12
Moldex or Other Good Preservative	1	Distilled Water[4]	71

FORMULA NO. 5.

a. Caragheen Moss	15.0	b. Starch Syrup	8.8
Water	30.0	Water	9.0
Cod Liver Oil	50.0	Spice Decoction[5]	0.1
Preservative	0.1		

FORMULA NO. 6.

Carragheen Moss	12	Cod Liver Oil	500
Distilled Water	300	Syrup, White	86
Moldex or Other Good		Distilled Water	91
Preservative	1	Spice Oil Mixture[6]	10

FORMULA NO. 7.

Gum Arabic	12	Water, Distilled	340
Gum Tragacanth	12	Sodium Salicylate[7]	5
Glycerin (28° Bé.)	130		

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[2] Ibid., Vol. 4, p. 114 (1939).
[3] Bennett, Chem. Formulary, Vol. 3, p. 126 (1936).
[4] Ibid., p. 125.
[5] Ibid., Vol. 4, p. 115.
[6] Bennett, Chem. Formulary, Vol. 3, p. 125 (1936).
[7] Ibid.

Formula No. 8.

Cod Liver Oil	52 oz.	Benzaldehyde	1 cc.
Water	88 oz.	Coriander Oil	1 cc.
Glycerine	10 oz.	Cardamom Oil	2 cc.
Tragacanth	100 g.	Tincture Vanilla [8]	5 cc.
Sassafras Oil	5 cc.		

Formula No. 9.

Calcium Hypophosphite	80 gr.	Almond Oil	15 min.
Sodium Hypophosphite	120 gr.	Glycerin	2 fl. oz.
Sodium Chloride	60 gr.	Cod-Liver Oil	8 fl. oz.
Gum Acacia	2 oz.	Distilled Water,[9] To make	16 fl. oz.
Elixir of Gluside	20 min.		

Formula No. 10.

Calcium Hypophosphite	32 gr.	Elixir of Gluside	40 min.
Sodium Hypophosphite	32 gr.	Cassia Oil	2 min.
Gum Acacia	1 oz.	Distilled Water,[10] To make	8 fl. oz.
Cod Liver Oil	4 fl. oz.		

Formula No. 11.

Cod Liver Oil	4 fl. oz.	Gluside	1 gr.
Gum Acacia	480 gr.	Distilled Water,[11] To make	8 fl. oz.
Cassia Oil	4 min.		

Mix the cod-liver oil and oil of cassia with the gluside and gum acacia in a dry mortar; add two fluid ounces of distilled water, and triturate until an emulsion is formed. Add gradually, with constant trituration, sufficient distilled water to produce eight fluid ounces of mixture.

Formula No. 12.

Calcium Hypophosphite	160 gr.	Clove Oil	6 min.
Sodium Hypophosphite	160 gr.	Lemon Oil	20 min.
Gum Acacia	2 oz.	Chloroform	15 min.
Tragacanth	½ oz.	Alcohol	1 fl. oz.
Cod-Liver Oil	40 fl. oz.	Distilled Water [12] To make	80 fl. oz.
Elixir of Gluside	4 fl. oz.		
Almond Oil	6 min.		

[8] Ibid., Vol. 1, p. 379 (1933).
[9] P. C.
[10] P. C.
[11] P. C.
[12] P. C.

FORMULA No. 13.

Tragacanth	108 gr.	Lemon Oil	40 min.
Alcohol	2½ fl. oz.	Syrup	1 fl. oz.
Almond Oil	3 min.	Distilled Water[13]	12 fl. oz.
Cod Liver Oil	12 fl. oz.		

FORMULA No. 14.

Cod Liver Oil	80.0	Milk Sugar	20.0
Pectin	0.5	Water[14]	20.0

FORMULA No. 15.

75 grams gum arabic powder is dissolved in 900 cubic centimeters water. This solution is placed in a tank fitted with mechanical stirrer, and 600 cubic centimeters cod liver oil are added. Stirring is continued for about a quarter of an hour, when a good primary emulsion is made. Further ingredients, such as oil of bitter almonds, hypophosphites, glycerophosphates, etc., are added, and the primary emulsion is fed to a De Laval homogenizer. Homogenization is carried out at a pressure of 3,500 pounds per square inch, when an absolutely stable and even emulsion is obtained of a suitable viscosity for pouring from a bottle.[15]

FROST BITE PREVENTION CREAMS

FORMULA No. 1.

Lanolin	10.0	Water	25.0
Cocoa Butter	15.0	Borax	1.5
Olive Oil	25.0	Benzoic Acid	0.5
White Beeswax	22.0	Perfume[1]	1.0

FORMULA No. 2.

Almond Oil	425.0	Spermaceti	62.0
Lanolin	185.0	Borax	4.5
Beeswax	62.0	Distilled Water[1a]	300.0

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[13] P. C.
[14] Bennett, Chem. Formulary, Vol. 3, p. 109 (1936).
[15] Ibid., Vol. 2, p. 371 (1935).
[1, 1a] Bennett, Chem. Formulary, Vol. 4, p. 51 (1939).

MINERAL OIL EMULSIONS

Formula No. 1.

Pharmagel-A	8.	g.	Alcohol	60.	cc.
Tartaric Acid	0.6	g.	Water, To make	500	cc.
Syrup	100.	cc.	Heavy Liquid Petrolatum [2]	500	cc.
Vanillin	0.04	g.			

Formula No. 2.

Gelatin, Alkali Treated (Pharmagel B)	5	g.	Syrup	100	cc.
Agar	2.5–5.0	g.	Alcohol	60	cc.
Sodium Bicarbonate	5	g.	Water To Make	500	cc.
Vanillin	0.04	g.	Mineral Oil [3]	500	cc.

Dissolve the gelatin and agar in 100 cc of water by the aid of heat, cool somewhat, then add the syrup, the vanillin dissolved in the alcohol, the sodium bicarbonate and finally enough water to make the solution measure 500 cc., add the mineral oil, mix intimately by vigorous agitation and then pass through the homogenizer several times until thoroughly emulsified. Place the emulsion in a closed container and allow to stand over night whence it will be found to be set to a soft gel due to the agar. This is now passed in the cold through the homogenizer again, which will accomplish a mechanical dispersion providing a fluid emulsion which will not again set to form a gel.[3]

Formula No. 3.

Gelatin (0.6% Porkskin, 250 Bloom)	6.0		Water, To make	440.0	cc
Tartaric Acid or Hydrochloric Acid	0.450		Vanillin	0.035	g.
Syrup	100.0	cc.	Alcohol	60.0	cc
			Heavy Mineral Oil	500.0	cc

Add the gelatin and tartaric acid to about 300 cc. of cold water, allow to stand a few minutes, then heat until dissolved. Add the syrup and finally enough water to make 440 cc. (I). While still quite warm add II then III, and mix well avoid-

J. Amer. Pharm. Assoc. XXIV, p. 1068.

ing the inclusion of air. Finally homogenize and bottle. Homogenization should be repeated if necessary until all the oil is completely dispersed.

Such an emulsion conforms to the New U. S. P. XI monograph for Emulsion of Liquid Petrolatum.[4]

FORMULA No. 4.

To obtain the best results, triturate sodium bicarbonate 10 grains, powdered tragacanth 20 and powdered acacia 60 grains to a smooth paste with glycerol 6 drams. Dissolve agar 17.5 grains in boiling water 2 fluid ounces, add this while hot to the mixture in the mortar while stirring. Then add liquid paraffin 3 ounces, 2–3 drams at a time. Triturate until cold, allow to stand for 1 hour, triturate again for 5 minutes and add water to complete 6 ounces. If an emulsifying apparatus worked by hand is available, a thick emulsion is obtained with agar 15, sodium bicarbonate 6 grains, liquid paraffin 3 ounces, tragacanth 5, acacia 5 grains, glycerol 2 drams, water to make 6 ounces.[5]

FORMULA No. 5.

Mineral Oil	gal.	Powdered Agar	1	lb.
Emulsone B or Gum Tragacanth	lb.	Citric Acid	2	oz.

Some sodium benzoate and aseptoform as preservative, and a small amount of vanillin and saccharin for flavoring purposes.[6]

FORMULA No. 6.

"A"

Gelatin	27 gr.	Water	1800 cc.

"B"

Mineral Oil	2000 cc.

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[5] P. C.

[6] Bennett, Chem. Formulary, Vol. 3, p. 101 (1936).

"C"

Agar	68 gr.	Tinc. Vanillin	4 fl. dr
Gum Arabic	110 gr.	Sodium Benzoate	2 dr.
Gum Tragacanth	110 gr.	Glycerin	4 fl. dr
Orange Oil	3 fl. dr.	Water	2000 cc.
Saccharin	10 gr.		

Make up "A" mixture and add "B" to same, using electric stirrer. Run mixture through colloid mill, using .010 gap setting.

Prepare "C" mixture and add to above. Run through colloid mill using .015 gap setting.

Add 960 grains phenolphthalein to each gallon of emulsion.[7]

FORMULA No. 8.

Heavy Liquid Petrolatum	500.0 cc.	Tincture of Vanilla	8.0 g.
Agar	5.5 g.	Tincture of Lemon	2.0 cc.
Sugar	120.0 g.	Cassia Oil	0.5 cc.
Acacia	30.0 g.	Water, To make	1000.0 cc.
Tragacanth	4.0 g.		

Mix the agar and the sugar with 300 cc. of boiling water and when they are dissolved strain the resulting solution and set it aside to cool. Triturate the powdered gums with the liquid petrolatum, then add the agar solution and whip the mixture with an egg beater. Finally add the tinctures and the oil and lastly enough water to make 1000 cc.[8]

FORMULA No. 9.

Powdered Tragacanth	5.0	Distilled Water	304.5
Moldex (Preservative)	1.0	Mucilage of Gum Acacia	30.0
Alcohol	10.0	Liquid Paraffin Medicinal	500.0
Glycerin	150.0		

If it is desired to include phenolphthalein in the emulsion, 10 of phenolphthalein is added in the place of an equal amount of water in the above formula.[9]

[7] Ibid., Vol. 1, p. 379 (1933).
[8] Ibid.
[9] Bennett, Chem. Formulary, Vol. 1, p. 380 (1933).

FORMULA No. 10.

Liquid Petrolatum	500 cc.	Vanillin	0.035 g.
Acacia	125 g.	Alcohol	60 cc.
Syrup	100 cc.	Distilled Water To make	1000 cc.

Mix the liquid petrolatum with the powdered acacia in a dry mortar, add 250 cc. of distilled water all at once and emulsify the mixture. Then add, in divided portions and triturating after each addition, a mixture of the syrup, 50 cc. of distilled water and the vanillin, dissolved in the alcohol. Finally add sufficient distilled water to make the product measure 1000 cc.[10]

LINIMENTS

FORMULA No. 1.

Wintergreen Oil	60 cc.	Hydrous Lanolin	65 g.
Menthol	19 g.	Water	210 cc
Saponin	1 g.	Chloroform	10 g.

Dissolve the saponin in water. Mix wintergreen and menthol, add chloroform. Bring the two mixtures together and stir in the lanolin.[11]

FORMULA No. 2.

Raisin Seed Oil	9 g.	Diglycol Stearate	15 g
Methyl Salicylate	15 g.	Water [11a]	61 g

FORMULA No. 3.

Avocado Oil	10 g.	Diglycol Stearate	22 g.
Methyl Salicylate	15 g.	Water	60 g.

Heat diglycol stearate with oil at 70°C., until dissolved. While mixing add warm methyl salicylate and then pour mixture slowly with rapid mixing into water heated to 70°C.[12]

[10] Ibid., Vol. 3, p. 101 (1936).
[11] Bennett, Chem. Formulary, Vol. 2, p. 360 (1935).
[11a] Ibid., Vol. 5, p. 70 (1941).
[12] Ibid.

FORMULA No. 4.

Camphor, Powdered	3 lb.	Blendene	10 lb.
Turpentine	26 lb.		

Mix the above until dissolved. Put in a pot fitted with a high speed agitator and while mixing rapidly add the following which has been dissolved previously:

Ammonium Chloride	7½ lb.	Water	28 gal.
Stronger Ammonia Water	3¾ lb.		

Continue mixing for about 15 minutes and bottle.[13]

FORMULA No. 5.

Ammonium Carbonate	30 g.	Camphor	30 g.
Water	240 cc.	Alcohol	30 cc.
Castile Soap	24 g.	Turpentine	q.s.
Hot Water	480 cc.		

Dissolve the ammonium carbonate in 240 cc. of water. Dissolve the soap in the hot water, then mix the two solutions. Dissolve the camphor in the alcohol and add to the first mixture; shake well. Now add the oil of turpentine in sufficient quantity to make a creamy emulsion, gradually adding and constantly shaking.[14]

CASTOR OIL EMULSION

FORMULA No. 1.

Castor Oil	2 oz.	Saccharin	4 gr
Powdered Acacia	6 dr.	Glycerin	3 dr
Peppermint Oil	3 min.	Cacao	2 dr
Powdered Tragacanth	16 gr.	Water To make	4 oz

A mixture of the cacao in the glycerin and water is made by boiling for five minutes. A mucilage of the acacia is made with 4 drams of the cacao mixture and the oils are gradually incorporated by trituration until emulsified. Then the remainder of the cacao mixture is added.[1]

[13] Ibid., Vol. 2, p. 358 (1935).
[14] Ibid., Vol. 1, p. 383 (1933).
[1] Bennett, Chem. Formulary, Vol. 2, p. 371 (1935).

FORMULA No. 2.

Sodium Hydroxide	9.8 gr.	Sodium Benzoate	100.5 gr.
Water	25.0 oz.	Triethanolamine	288.0 min.
Castor Oil	6 lb. 5.0 oz.		

Dissolve the sodium hydroxide in water, add sodium benzoate and add triethanolamine.

Mix with oil and run through colloid mill. For flavor use saccharine (water soluble) vanilla and lemon extract.[2]

FORMULA No. 3.

Aluminum hydroxide gel (3 per cent solids), 400 g.; castor oil, 700 g.; water, 50 g.; flavor and sweetening to suit.

The quantities of water, gel and castor oil are placed together, flavoring matter and sweetening having been previously added to the castor oil.

The whole is then beaten together mechanically, forming a thick, creamy mass which is more or less stable according to the amount of mixing.

To prepare the completed product for internal administration, this cream is usually passed through a homogenizer or similar suitable emulsifying apparatus. The final product is a finely dispersed, stable and white emulsion containing approximately 60 per cent castor oil combined with approximately 1 per cent of aluminum hydroxide on a dry basis.[3]

FORMULA No. 4.

Pharmagel-A	8 g.	Alcohol	60 cc.
Tartaric Acid	0.6 g.	Water, To make	500 cc.
Syrup	50 cc.	Aromatic Castor Oil N.F.	500 cc.

In making an emulsion of castor oil, the oil should be warmed to above 50°C. to render it more fluid and then mixed.[4]

[2] Ibid., Vol. 1, p. 379 (1933).
[3] Ibid., Vol. 4, p. 81 (1939).
[4] Amer. J. Pharm. III 4 (1939).

WATER DISPERSABLE ANTISEPTIC OIL

Diglycol Laurate	20	Mineral Oil[1]	77
Coal Tar Distillate	3		

ANTISEPTIC LIQUID

Oleic Acid	7	Triethanolamine	10
Ti-tree Oil	3	Glycerin	2
Coconut Fatty Acid	12	Water[2]	66

MERCURIC NITRATE OINTMENT

Mercuric Nitrate	11.34	Beeswax U.S.P.	5.00
Nitric Acid	1.35	Cholesterol	1.50
Distilled Water	32.31	White Petrolatum	48.50

Mix 11.34 g. of finely powdered mercuric nitrate with 1 cc. of water, preferably in a mortar, and add 1.35 g. of nitric acid, accurately weighed. Triturate in the mortar until solution is effected and add 31.31 g. of water, slowly and with constant stirring.

Melt the white petrolatum, the cholesterol finely powdered and the white wax in a suitable dish. Continue the heat until the temperature of the mixture is raised to 80°C., and the cholesterol has completely dissolved. Stir the mixture until it congeals. By trituration, slowly incorporate the aqueous solution of mercuric nitrate into the ointment base. Care should be taken to avoid contact with metallic instruments or containers.[3]

POISON IVY LOTION

Ammonium Oleate	5.0	De-Odorized Kerosene	77.4
White Mineral Oil	10.5	Eugenol	5.0
Menthol	0.1	Carbon Tetrachloride	2.0

Dissolve the menthol in the eugenol, add the mineral oil and the carbon tetrachloride and then dissolve the ammonium oleate in the mixture. Add this to the kerosene.[4]

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[1] Bennett, Chem. Formulary, Vol. 4, p. 59 (1939).
[2] P. C.
[3] Ibid., Vol. 5, p. 69 (1941).
[4] Ibid., Vol. 2, p. 365 (1935).

PSORIASIS LOTION

Mace Oil	10	Rose Water	5
Olive Oil	10	Lecithin	50
Ammonia	15	Chloroform	½
Essence of Rosemary	5	Perfume to suit [5]	

COLCHICINE EMULSION

Stearic Acid	1.50 g.	Lanolin	8.00 g.
Morpholine	0.53 cc.	Colchicine [6]	0.12 g.
Tap Water	20.00 cc.		

SULFANILAMIDE EMULSION

Sulfanilamide	175 gr.	Calcium Hydroxide [7] (Saturated Solution)	8 fl. oz.
Cod Liver Oil	4 fl. oz.		
Oleic Acid U.S.P.	36 min.		

HAY FEVER OINTMENT

Lanolin Anhydrous	50	Menthol	½
Yellow Petrolatum	25	Epinephrin Solution 1-1000	2
Ethyl Amino Benzoate	5	Distilled Water	23

(1) Triturate ethyl amino benzoate and menthol with a portion of the yellow petrolatum until smooth. Gradually add the remainder of the petrolatum and the lanolin.

(2) Mix epinephrin solution with distilled water and add this aqueous solution slowly under trituration to No. 1 and mix until homogeneous.[8]

DISINFECTANT EMULSION

Orthophenyl Phenol	10–40%	Sulphonated Castor Oil [9]	To make 100%
Terpene Ether	15%		

[5] Ibid., Vol. 1, p. 142 (1933).
[6] P. C.
[7] Drug & Cosmetic Industry *50,* 146 (1942).
[8] Bennett, Chem. Formulary, Vol. 1, p. 386 (1933).
[9] U. S. 2,289,476.

CHAPTER XIV

PAINT EMULSIONS

FORMULA NO. 1.

Hydrated Lime	43.0	Mica	5.0
Hydraulic Cement	19.5	Gum Arabic	1.6
Talc	12.0	Gum Karaya	0.5
Metronite	11.5	Irish Moss	0.1
Salt	6.5	Calcium Stearate	0.3

Add water to suit before use.[1]

FORMULA NO. 2.

The following mixtures are prepared separately

1. Potato Starch	10	Water	20
Water	30	Caustic Soda (10° Bé.)	10
Caustic Soda (10° Bé.)	10	3. Water	150
2. Casein	6	Linseed Oil Varnish	80

These three mixtures can be stirred together into a smooth emulsion which will remain stable for 6–8 months.[2]

FORMULA NO. 3.

1. Casein	30	2. Formaldehyde (40%)	2
Water	150	Water	5
Borax	3.5	3. Rosin	15
Phenol	1	Linseed Oil Varnish	15
		White Spirit	10

[1] Schloz, Can. 317,827 (1931).
[2] Hadert, Casein & Its Uses.

The casein is soaked in hot water, and the borax and later the phenol are added. After standing for 24 hours, the ingredients of group 2 are mixed in, followed by the ingredients of group 3 which had been mixed hot previously. Since the pigments are more easily wetted in oil than in water, it is advisable to grind them with the oil binder 3, before this is emulsified with the casein solution. The amount of pigment averages about 6 to 8 times the amount of the binder. Casein paints thus made excel by their good brushability and increased water resistance.[3]

FORMULA No. 4.

Dehydrated Castor Oil	33.41	Phenol	0.06
Lithopone	39.81	Ammonium Hydroxide	23.41
Casein	3.31		

Mix well until uniform; dilute before using.[4]

FORMULA No. 5.

Shellac	30	Water	65.5
Ammonium Bisulphate	4.5		

Mix until dissolved and then add

Linseed Oil	30

Emulsify with electric mixer and add

Lithopone[5]	380

FORMULA No. 6.

Water Ground Mica	2 lb.	Casein, Muriatic (80 Mesh)	1 lb.
Lithopone or Titanox	6 lb.	Sodium Fluoride	2 oz.

FORMULA No. 7.

Montan Wax, Double Bleached	7.0	Potash, Caustic	0.8
		Water Soluble Dye	2.0
Potassium Oleate	3.0	Water	87.2

[3] Ibid.
[4] Bennett, Chem. Formulary, Vol. 5, p. 341.
[5] Ibid.
[6] P. C.

The potash, the soap and the dye are dissolved in the boiling water. The boiling solution is then slowly poured into the wax melt adding it in small portions at a time. Care must be taken that a drop in temperature does not cause a separation. It is essential that the mixture be stirred constantly while cooling.[7]

FORMULA No. 8.

Crude wool fat, refined tung oil and rosin, are melted up in the respective proportions of 360 : 40 : 250, the melt being incorporated with 43 parts of ammonia solution, 100 parts alcohol and 1207 parts water and the resulting emulsion agitated till cold. The product at this stage, a viscous, yellowish-white emulsion, may be directly employed as a paint. An example of a quick-drying paint comprises 1000 parts of above emulsion, 80 parts chrome oxide, 150 parts titanium white and 15 parts of a 33 per cent solution of a cobalt-lead-manganese drier.[8]

FORMULA No. 9.

Double Boiled Oil, with Driers	50	Sodium Silicate	5
Water	45	Pigment	50

The oil, which may be diluted if required with 120°F. flash white spirit, should be added to the aqueous phase in a slow stream with rapid and vigorous stirring.[9]

FORMULA No. 10.

1. Sodium Silicate	10	Zinc Dimethyldithio Carbamate	½
Ammonia	10	2. 60% Latex	100
Water	10	Whiting	200
Zinc Oxide	5	Spindle Oil	60
Sulphur	3	Glue	5

[7] Ibid., Vol. 4, p. 327 (1939).
[8] P. C.
[9] Bennett, Chem. Formulary, Vol. 1, p. 269 (1933).

The two solutions are made separately as indicated, and mixed. The more alkaline varieties of sodium silicate cause precipitation of latex by reason of hydrolysis. If, however, ammonia be added to the solution this increases the OH ion concentration and prevents splitting of the silicate, so that the latex is thickened and rendered stable.[10]

FORMULA NO. 11.

A. Potato Starch	10	Caustic Soda (10° Bé.)	10
Cold Water	30		

Mix the starch with cold water and add the caustic slowly in a thin stream till a transparent thick liquid is obtained.

B. 90-Mesh Lactic Casein	6	Caustic Soda (20° Bé.)	10
Water	20		

Soak the casein in the warm water, not over 130°F., and add the caustic whilst stirring.

C. Medium Congo Copal	20		
Linseed Oil	50	Linseed Oil Varnish	80
White Spirit	30	Water	150
Manganese (as Resinate)	0.1		

Grind in the required amount of pigment with the oil varnish and then stir in the water. Run the three solutions together through a Hurrel Homogenizer and the resulting emulsion will be stable for a year. If for export to a hot country, it is advisable to add a little preservative, e.g., metachlor-paracresol.[11]

FORMULA NO. 12.

Trihydroxyethylamine Linoleate	0.6	Varnish	16.0
Glue	10.0	Naphtha	4.0
Water	32.0	Sodium Ortho Phenyl Phenate[12]	0.1

[10] Ibid.
[11] P. C.
[12] Ibid., Vol. 1, p. 270 (1933).

FORMULA NO. 13.

Beeswax	70	Shellac	10
Japan Wax	44	Potassium Carbonate	30
Montan Wax	25	Water	730

Boil together and mix well until emulsified. Cool and add with stirring

Alcohol	40	Trioxymethylene[13]	50

FORMULA NO. 14.

Lithopone	60.0 lb.	Dowicide "B"	0.45 lb.
Asbestine	20.0 lb.	Sodium Alginate	1.0 lb.
Mica	8.0 lb.	Raw Chinawood Oil	9.0 lb.
Vehicle		Cobalt Drier 6%	0.48 oz.
Water	51.0 lb.	Wetting Agent	1.68 oz.

Place the water (preferably from the hot water tap at approximately 100°F.) in the mixer. Add the Dowicide "B" and stir until dissolved. Add the sodium alginate and stir for a full 20 minutes or until completely dispersed. Add wetting agent and then the chinawood oil (with the drier added to the oil before adding to the water mixture). Stir the oil and alginate mixture for 10 minutes and then add pigment and filler. Stir for one hour. Remove from mixer and put into containers.[14]

FORMULA NO. 15.

Sodium Silicate	2 lb.	Pale Boiled Linseed Oil	¼ lb.
Soap	½ lb.	Water (Boiling)	1 gal.

Mix very thoroughly. A little alum may be added to increase water resistance.[15]

FORMULA NO. 16.

Oiticica Oil	120	Manganese Dioxide
Lead Oxide	6	

[13] Bennett, Chem. Formulary, Vol. 4, p. 300 (1939).
[14] Ibid., p. 297.
[15] P. C.

Heat to 250°C. and then reduce to 200°C. and add

Potassium Silicate	13	Water	sufficient
Milk of Lime	16		

Agitate violently until cool.[1]

RESIN OIL EMULSION

Solution "A"

Ester Gum	62	Co. Linoleate Drier (6% Co.)	1½
Bodied Linseed Oil	50	Pb. Linoleate Drier (16% Pb.)	4½
Pine Oil	21	Oleic Acid	24
Mineral Spirits	62		

Solution "B"

Powdered Casein	27	Emulsifier (2 Amino-2 Methyl-1 Propanol)	15
Preservative (Moldex)	⅜	Water	536

Mix the resin, cut in the mineral spirits, with the bodied linseed oil, pine oil, driers, and oleic acid.

Place the casein in mixer, add the water slowly, stirring so that casein is wetted, add the preservative and emulsifier and continue stirring for several minutes.

Add Solution "A" slowly to Solution "B" with constant high speed agitation until emulsification is complete.[1]

SEMI-PASTE PAINTS

Formula No. 1.

Albalith-335, 332 or 836	790	Ester Gum Oil Emulsion	622

Formula No. 2.

Cryptone ZS-830	376	Ester Gum Oil Emulsion	625
China Clay	230		

These semi-pastes are designed to be thinned 2–1 with water for brush application.

The illustrative formulae of the emulsion and semi-pastes given here can be modified in many ways, but in making

[16] Ibid., Vol. 3, p. 52 (1936).

substitutions, or if the percentages of the ingredients are changed, the new system must be balanced or the breaking of the emulsion may follow. This adds a variable that is different from the type of problem that the paint manufacturer encounters in his everyday paint making and introduces elements that cause slow progress to be made in investigational work.[2]

"PICCOLYTE" OIL EMULSION (V-338)

SOLUTION "A" 30.5%

Piccolyte S-100 Resin	27.2%	Co. Linoleate Drier (6% Co.)	.5%
Lithographic Oil #8	22.0%	Pb. Linoleate Drier (16% Pb.)	1.9%
Pine Oil	9.3%	Oleic Acid	11.9%
Mineral Spirits	27.2%		

SOLUTION "B" 69.5%

Casein B-5	5.2%	2 Amino-2 Methyl-1 Propanol	2.9%
Moldex or Dowicide "A"	.1%	Water	91.8%

Dissolve the Piccolyte resin in the mineral spirits and mix with the lithographic oil No. 8, pine oil, driers, and oleic acid.

Place the casein and preservative in a pony or other type mixer, add the water slowly, stirring so that casein and preservative are wetted, add the 2 Amino-2 Methyl-1 Propanol, and continue the stirring for several minutes.

Add Solution "A" slowly to Solution "B" with constant agitation until emulsification is complete.[3]

"PICCOLYTE" OIL EMULSION SEMI-PASTE

INTERIOR

PIGMENT 54.5%

Cryptone ZS-830	62%	China Clay	38%

VEHICLE 45.5%

Piccolyte Emulsion V-338	93.1%	Water	6.9%

The pigment, emulsion and water should be mixed together and then milled on a roller or buhrstone mill at a loose setting.[4]

[1–4] inc.: N. J. Zinc Co., New York, N. Y.

CHAPTER XV

PAPER PROCESSING EMULSIONS

PAPER SIZINGS

FORMULA No. 1.

Paraffin Wax	75	Soap	10
Carnauba Wax	25	Water[1]	To suit

FORMULA No. 2.

Japan Wax	100	Water	40
Soap	10		

Boil and stir until homogeneous. This is diluted with boiling water and stirred before use.[2]

FORMULA No. 3.

Rosin	70	Beeswax	2
Soda Ash	7	Water	21

Boil together until a sample solidifies on cooling. This may be shipped solid and is dispersed in hot water when needed.[3]

FORMULA No. 4.

700 parts of resin are melted with 200 parts of turpentine oil of high boiling point, e.g., that known commercially as Yarmor pine oil, and are stirred into a solution of a caseinate-

[1] P. C.
[2] Ibid., Vol. 1, p. 476 (1933).
[3] Ibid., p. 475.

resin soap emulsifying medium in 1,000 parts of water preferably using a steam jet or high-speed rotary stirrer. The resin soap is made by adding 100 parts of commercial caseinate powder to 80 parts of powdered resin and a 10 per cent solution of ammonia is added with mild heating to the mixture which is kneaded till saponification is completed and the mixture of swollen ammonium caseinate and ammonium resinate has reached its highest viscosity.[4]

FORMULA No. 5.

Ten parts of soy bean protein are treated with 0.7 part of sodium carbonate by heating to 60°C. under mild agitation with 60 parts of water. To this is added five parts of ammonium oleate for other suitable emulsifying agent, such as turkey red oil, gums like gum arabic, sodium stearate, etc. To this mixture, 40 parts of molten paraffin is slowly run in, under agitation. The mixture of casein, emulsifier, and paraffin is stirred with a high speed stirrer or other suitable equipment. The time of mixing is usually approximately 15 minutes, the mixture then being diluted with about 1000 parts of water at approximately 60°C. These temperatures can be adjusted, depending upon the melting point of the paraffin used. The emulsion can likewise be made through the use of a colloid mill or other suitable equipment.[5]

FORMULA No. 6.

Rosin	85	Water	100
Colloidal Clay	15	Caustic Soda[6]	2

FORMULA No. 7.

Petroleum Resin	37	Caustic Soda	1
Colloidal Clay	18	Water[7]	To suit
Casein	1⅕		

[4] Ibid., Vol. 2, p. 345 (1936).
[5] Ibid.
[6] Manson, U. S. 1,990,457 (1935).
[7] Paper Makers' Assn., London, Eng. (1942).

WATERPROOFING EMULSIONS FOR PAPER

FORMULA No. 1.

Paraffin Wax	33	Glue	1
Silicate of Soda	4	Water	60
Alum	2		

The silicate of soda used in the above formula is a commercial form of syrupy consistency containing about 50 per cent of water. This silicate of soda syrup is mixed with 65 per cent of the total water. The remaining 35 per cent of the total water is used to dissolve the alum. The glue is added to the diluted silicate of soda. The wax composition is prepared by first melting the wax, adding the silicate of soda solution containing the glue and agitating, finally adding the alum solution with agitation. The temperature at which the composition is prepared is about 170°F.[1]

FORMULA No. 2.

Paraffin Wax	32.50	Alum	2.75
Montan Wax	0.85	Glue	0.40
Silicate of Soda	5.00	Water	58.50

In this case the silicate of soda specified is a syrup containing about 50 per cent of water. This syrup is diluted with 65 per cent of the total water and the alum is dissolved in the remainder of the water employed.

The glue is dissolved in the silicate of soda solution. It is desirable to add 1 or 2 per cent of phenol, based on the amount of glue, in order to preserve the latter. The waxes are melted together and the silicate of soda solution containing the glue is added thereto with thorough agitation, the temperature being about 170°F. The alum solution is then added and agitation continued for a short time.[2]

[1] Bennett, Chem. Formulary, Vol. 2, p. 350 (1935).
[2] Ibid.

FORMULA No. 3.

Paraffin Wax	31.00	Alum	1.35
Montan Wax	7.00	Water[3]	58.00
Silicate of Soda	2.65		

FORMULA No. 4.

Paraffin (130°F.)	22.5	Water[4]	74.5
Trihydroxyethylamine Stearate	3.0		

FORMULA No. 5.

Paraffin Wax	50	Water[5]	980
Ammonium Stearate	70		

FORMULA No. 6.

Trihydroxyethylamine Stearate	4½	Stearic Acid	½
		Water	100

Boil and mix until smooth; pour into this slowly while stirring vigorously

Paraffin Wax (Heated to 90–100°C.)	30

Stir until cool.

Use 1 part of above emulsion to 5–10 parts of warm water.[6]

FORMULA No. 7.

Latex (60%)	50	Sodium Silicate	5
Paraffin Emulsion (50%)	30	Water	30

The paraffin emulsion is diluted with the water and the silicate stirred in. The latex is added last and stirred until homogeneous.[7]

[3] Ibid.
[4] Ibid., p. 349.
[5] Kniffler, U. S. 1,266,955 (1918).
[6] Bennett, Chem. Formulary, Vol. 3, p. 255 (1936).
[7] Ibid., Vol. 2, p. 348 (1935).

FORMULA No. 8.

Stearic Acid	4 lb.	Triphenyl Phosphate	8 lb.
Japan Wax	5 lb.	Dibutyl Phthalate	1 lb.

Heat to 90°C. and add

Water Shellac (40%)	56 lb.	Triethanolamine	2 lb.

Cool to 70°C. and add successively with vigorous stirring

Ammonia (28%)	1 qt.	Water	3 gal.
Water	3 gal.	Latex + 4% Sulphur	3 lb.
Ammonia (28%)	3 qt.	Water[8] To make	28 gal.

EMULSION FOR HIGH LUSTRE PAPER

FORMULA No. 1.

Marseilles Soap	2.0	Water, Free of Calcium[9]	40.0
Montan Wax	6.5		

FORMULA No. 2.

Yellow Laundry Soap	7 lb.	Water	12½ gal.
Carnauba Wax	50 lb.		

Boil with live steam till thoroughly emulsified (from 3–4 hours).

Cool to 35°C. and add

Ammonia (28°)	2 lb.	Cold Water to make	50 gal.

The emulsion should be allowed to stand for at least 24 hours before use as it seems to improve with age.[10]

FORMULA No. 3.

Dry Castile Soap	12 lb.	Boil till dissolved, then add	
Water	25 gal.	Carnauba Wax	75 lb.

Boil three hours; cool to 100°F. and add 3 pints 26° ammonia. Make up to 75 gallons with water. This emulsion is added to the casein coating mixture.[11]

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[8] Ibid., Vol. 3, p. 255 (1936).
[9] P. C.
[10] Ibid., Vol. 3, p. 254 (1936).
[11] Bennett, Chem. Formulary, Vol. 2, p. 348 (1939).

DE-INKING PRINTED PAPER

For separating the cellulosic fibers of filled and printed paper, the paper is beaten in a solution containing sodium hydroxide, sodium metasilicate or sodium phosphate in such proportion as to give the solution a pH of 9.0–12.6 until the paper has been substantially disintegrated, and an emulsifying agent such as a soap or sulphonated oil is then added to the resulting aqueous suspension and the beating is continued for a short time. The material is filtered through a sieve fine enough to retain the cellulosic fibers but coarse enough to pass the fillers and ink particles.[12]

[12] Ibid., Vol. 2, p. 346 (1935).

CHAPTER XVI

POLISH EMULSIONS

AUTOMOBILE POLISHES

Formula No. 1.

1. Acetic Acid (80%) or Lactic Acid	4	Rosin Oil	4
Water		Camphor Oil, Viscous	2
2. Spindle Oil, Refined	9	3. Neuburger Chalk or Tripoli. Finest[1]	7

To solution 1 add the mixture 2. Stir until homogeneous, and stir in 3.

Formula No. 2.

a. Ammonium Linoleate	20	*c.* Water	15
Turpentine	15	*d.* Whiting	45
b. Alcohol	5		

Dissolve *a,* add *b, c,* and ultimately *d.* Mix thoroughly.[2]

Formula No. 3.

A. Carnauba Wax	30	B. Water	70
Glyco Wax B	20	Borax	10
Naphtha or Varnolene	68		
Turpentine	17		

Melt "A" together but do not heat above the boiling point of water. Meanwhile dissolve "B" while heating to a boil.

Run "A" into "B" *slowly* while stirring *vigorously.*[3]

[1] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[2] Ibid., p. 437.
[3] Ibid., Vol. 1, p. 418 (1933).

FORMULA NO. 4.

Carnauba Wax	120	Oleic Acid	3
Kerosene	50	Benzaldehyde	6
Stearic Acid	15	Triethanolamine	8

Melt the carnauba wax, stearic acid and oleic acid. Remove from fire and add the kerosene and the benzaldehyde. Stir thoroughly. Now add a hot solution (80–85°C.) consisting of 240 parts of water and the triethanolamine. Stir well until a smooth emulsion is formed, then add sufficient hot water to make 825 parts. Continue stirring until nearly cool then bottle.[4]

FORMULA NO. 5.

Carnauba Wax	8	Paraffin Wax	4
Montan Wax			

These are saponified in a hot solution of:

Potash	3	Water	40

Replace any evaporation with additional warm water. There is then added to this 20 parts of turpentine.[5]

FORMULA NO. 6.

a. Carnauba Wax, Gray	10	*b.* Black Soap	1½
Montan Wax, Bleached	3	Water	10
Japan Wax	5	*c.* Solvent (Turpentine White Spirit, etc.)	60
Scale Wax (50–52°C.)	2		

Melt *a* at 95–100°C., prepare the hot soap solution *b*.

Add *c* with good agitation, and stir until it begins to go heavy (at about 48°C.).[6]

FORMULA NO. 7.

a. Carnauba Wax, Gray	15	*c.* Solvent (Turpentine, White Spirit, or a Mixture of both and 10 parts of Kerosene)	30
Beeswax or Japan Wax	5	*d.* Black Soap	1
Glycowax	5	Water	7–10
b. Kaolin or Floated Chalk	30–35		

[4] Ibid., Vol. 2, p. 421 (1935).
[5] Ibid., Vol. 1, p. 430 (1933).
[6] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).

FORMULA No. 14.

To 3½ gal. of pale blown castor oil, add ¾ gal. of ortho-dichlorbenzol. This is mixture No. 1. To 15 gal. of water, add 11 gal. of neutral pale mineral oil and ¾ gal. of ammonia, which has been previously made up of one part of ammonia of 26° Bé. and 4 parts of water. This is mixture No. 2. Mixture No. 1 and mixture No. 2 are combined and agitated for about 5 minutes. Three and one-half gallons of special petroleum spirit is added and the whole mass is now stirred about 10 minutes. It is then run through a colloid mill and is ready for use. Alternately, all of the ingredients may be mixed in a single batch and passed through the colloid mill, which breaks up the particles to a fine degree. This obviates preparing separate mixtures.[14]

FORMULA No. 15.

Kieselguhr	8	Glycerin	2
Paraffin Wax	8	Water	40
Methylated Spirit	2	Gum Tragacanth[15]	¼

FORMULA No. 16.

Kieselguhr (Levigated)	11	Kerosene	16
Silica (Levigated)	9	Soft Paraffin Wax	2
Yellow Ochre	1	Powdered Soap[16]	1
Red Ochre	1/10		

FORMULA No. 17.

Mineral Oil, White	35	Oleic Acid	3
Beeswax	5	Potash Carbonate	½
Carbon Tetrachloride	10	Ammonia	½
Kieselguhr	3	Water[17]	43

[14] Tumbler, U. S. 1,969,387.
[15] Bennett, Chem. Formulary, Vol. 3, p. 286 (1936).
[16] Ibid., Vol. 1, p. 418 (1933).
[17] Bennett, Chem. Formulary, Vol. 4, p. 404 (1939).

FORMULA No. 18.

a.	Montan Wax, Bleached	3.0	*b.*	Potash Carbonate	0.2
	Carnauba Wax Residues	4.0		Borax	0.3
	Yellow Beeswax	1.5		Black Soap	0.5
	Japan Wax	1.5		Water	35.0
	Glycowax	1.0	*c.*	Kerosene	10.0
				Turpentine	10.0

Melt *a* at about 100°C., and add *b*, of equal temperature, to it with very good agitation. Watch closely to prevent from foaming over (carbon dioxide formed!) and keep boiling until the saponification is finished and add *c*. Stir until cold.[18]

FORMULA No. 19.

Naphtha	2½ pt.	Ammonia	oz.
Mineral Oil	2½ pt.	Water[19]	pt.
Diglycol Laurate	4 pt.		

FORMULA No. 20.

Oleic Acid	80	Tragacanth	6
Liquid Paraffin	250	Water, To make	1000
Potassium Hydroxide	16		

Mix the oleic acid with the paraffin and slowly add the potassium hydroxide, previously dissolved in 200.0 of water. Soak the tragacanth in 500 cc. of water until fully absorbed, then heat to boiling, and when cool stir into the above emulsion.[20]

FORMULA No. 21.

Oleic Acid	2 lb.	Water	28 lb.
White Mineral Oil	12 lb.	Triethanolamine	13 oz.
Carnauba Wax	2½ lb.	Infusorial Earth	100 lb.
Yellow Beeswax	2 lb.	Gum Tragacanth	4 lb.

Take the carnauba wax, beeswax, oleic acid and white mineral oil and melt at gentle heat. In another vessel heat to

[18] Ibid., p. 405.
[19] Ibid., Vol. 5, p. 534 (1941).
[20] Ibid., Vol. 1, p. 418 (1933).

near boiling point the water and the triethanolamine. Add the oil-wax mixture to the water mixture in a slow stream under steady stirring and retain at near boiling temperature until a smooth emulsion has been formed. Then remove from fire and continue stirring until nearly cold. Now add to the emulsion the infusorial earth, mix well and let dry until all the water has been expelled. Then add the powdered gum tragacanth, mix thoroughly and sift. 8 to 12 ounces of the powder are sufficient to make 1 gallon of polish by merely adding sufficient water.[21]

FORMULA No. 22.

a. Olein	10 cc.	*b.* Alcohol	6 cc.
Mineral Oil	20 cc.	Ammonia (0.910)	6 cc.
Petroleum	20 cc.	*c.* Infusorial Earth[22]	10 g.
Turpentine Oil or White Spirit	28 cc.		

FORMULA No. 22a

Olein, Distilled	15 g.	Chalk, Neuburg, Fine	45 g.
White Spirit (Lacquer Benzoline)	90 g.	Ammonia, 25%	1 g.

Saponify this mixture adding the ammonia with thorough agitation.[22a]

FORMULA No. 23.

Paraffin Oil	20.0	Tragacanth, Gum	0.6
Blown Castor Oil	2.0	Sodium Benzoate	0.2
Kieselguhr	4.0	Water[23]	72.2
China Clay, Colloidal	1.0		

FORMULA No. 24.

Soap	20	Mineral Oil	5
Kieselguhr	10	Naphtha	
Kaolin	15	Water[24]	40
Iron Oxide	5		

[21] Ibid., Vol. 2, p. 421 (1935).
[22] Bennett, Chem. Formulary, Vol. 3, p. 285 (1936).
[22a] Ibid., Vol. 4, p. 404 (1939).
[23] Ibid., p. 405.
[24] Ibid., Vol. 4, p. 403 (1939).

FORMULA No. 25.

Sulphonated Olive Oil (30%)	10	Amyl Alcohol	10
Mineral Oil	30	Carnauba Wax (Powdered)	5
Pumice Powder	5	Water	40

Mix the oils, wax and alcohol; add the water slowly with good stirring; mix in other ingredients.[25]

FORMULA No. 26.

Turpentine	25	Iron Oxide	5
Naphtha	15	Mineral Oil	2
Oleic Acid	10	Water	10
Kaolin	15	Triethanolamine[26]	3
Whiting	15		

FORMULA No. 27.

Turpentine	38½	Iron Oxide	5
Oleic Acid	15	Mineral Oil	5
Kaolin	20	Water	10
Kieselguhr	5	Potash, Caustic[27]	1½

FORMULA No. 28.

Water	55	Turpentine	15
Glue, Pale	6	Spindle Oil, Thin	14
Lactic Acid	3	Perfume (Pine Needle Oil, or similar oil)[28]	To suit
Sand, Finely Sifted, "0000," or "Silver-Tripoli," or Kieselguhr	7		

FORMULA No. 29.

a. Soluble Oil	35	*c.* Soluble Oil	25
Talloil	30	Kerosene	15
b. Caustic Soda (38° Bé.)	8	*d.* Water	5–10
		e. Turkey Red Oil	5– 7

Mix *a*, add *b* at 70°C., very slowly with agitation. Boil. When saponified, add *c*, and *d* with stirring (all hot); *e* may be added is desired.[29]

[25] Ibid., Vol. 2, p. 421 (1935).
[26] Ibid., Vol. 4, p. 403 (1939).
[27] Ibid.
[28] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[29] Ibid., p. 405.

FORMULA No. 30.

a. Oleic Acid	5.0	*c.* Kerosene	70.0
Rosin, In small pieces	6.0	Turkey Red Oil	8.0
Alcohol		*d.* Water	5–10.0
b. Caustic Soda (38° Bé.)	2.5		

Heat *a*—with the amount of alcohol desired. Mix well, and add *b* at about 70°C. Add *c* with continuous agitation. The be added if desired.[30]

FORMULA No. 31.

Wax	25.0	Turpentine	20.0
Stearic Acid	2.5	Water[31]	To make 100.0
Potash, Caustic	2.5		

FORMULA No. 32.

Wax	20.0	Triethanolamine	1.5
Stearic Acid	2.5	Turpentine	25.0
Ammonia (0.88)	2.0	Water[32]	To make 100.0

FORMULA No. 33.

White Mineral Oil	80	Triethanolamine	4
Deodorized Mineral Oil	9	Methanol	4
Stearic Acid	9	Water	120

Mix the white oil and mineral oil and add the stearic acid. Heat the mixture to about 140°F. at which time the stearic acid will dissolve to give a clear solution. In a separate container mix the triethanolamine, methanol and water and heat likewise to about 140°F. Then add the first mixture to this and stir vigorously until the emulsion is smooth. Continue to stir gently until cool.[33]

FORMULA No. 34.

a. White Oil	20	*b.* Water	100
Castor Oil	10	Neuburg Chalk	25
Solvent Naphtha	5	Kaolin, Finest	5
Glycerin	5	Bentonite	3
Turpentine	15		
Diglycol Laurate	2½		

[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Ibid., Vol. 2, p. 421 (1935).

Make mixtures *a* and *b*, and add *a* to *b*. Homogenize, if desired.[34]

FORMULA No. 35.

White Spirit	2½ pt.	Water	5 pt.
Mineral Oil	2½ pt.	Glycerin	1 pt.
Turkey Red Oil	4 pt.	Formaldehyde[35]	8 oz.
Ammonia	1 oz.		

FORMULA No. 36.

Fuller's Earth	8	Bentonite	

Mix the oils together first and add the abrasive powders, then the water, ammonia, glycerin, and formaldehyde; stir rapidly until a smooth mixture is obtained.[36]

FORMULA No. 37.

a. Yellow Beeswax or Montan Wax, Refined	36.0	*b*. Potash Carbonate	3.0
		Water	140.0
		c. Turpentine or Substitute	10.5

Melt *a* carefully; add slowly a *boiling* solution *b*, boil until the saponification is completed. Cool, thin with *c*.[37]

FORMULA No. 37a

Yellow Wax	10	Soft Soap	½
Air-Floated Tripoli	18	Water	2½
White Spirit	19		

Melt the wax in a double pan and add the powder slowly; keep stirring while slowly adding the white spirit. Dissolve the soft soap in the water and add to the mix with constant stirring. On cooling this forms a soft paste.[37a]

FORMULA No. 38.

Yellow Wax	20	Turpentine Substitute	40
Commercial Silica, Very Finely Powdered	40	Soft Soap	1
		Water	5

[34] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[35] Ibid., Vol. 3, p. 285 (1936).
[36] Ibid., p. 286.
[37] Ibid., Vol. 4, p. 405 (1939).
[37a] Bennett, Chem, Formulary, Vol. 3, p. 285 (1936).

Melt the wax and incorporate the powder, slowly adding the turpentine substitute, finally stir in the soap, previously dissolved in the water. Some may prefer it to be without the soap, but experience shows it to be worth its slight softening effect in yielding a higher and better polish. The paste may be tinted with ferric oxide.[38]

FLOOR POLISHES

Formula No. 1.

"Aquamel"	15	Water	225
Carnauba Wax	25		

Heat the wax and "Aquamel" together till a clear jelly is obtained. Then add the water which must be as near boiling as possible. Stir thoroughly till cool.[1]

Formula No. 2.

Carnauba Wax	10.0	Refined Shellac	1.4
Triethanolamine	1.4	Ammonium Hydroxide	0.2
Oleic Acid	1.4	Water to Make[2]	
Borax	1.0		

Formula No. 3a

A stable emulsified floor wax can be obtained with 40% of a mixture of 1 part of beeswax, 1 part of paraffin, 1% of soap, 0.33% of soda ash, and 2.6–2.7% of methyl cellulose. The soap and soda ash are dissolved in boiling water, and an aqueous 5% solution of methyl cellulose added. This is warmed and the melted wax added. The product is then stirred while cooling to give a good emulsion.[3a]

Formula No. 3b

63 parts of a 5% aqueous solution of methyl cellulose are mixed into 1 part of potassium carbonate and 3 parts of soap

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[38] Ibid., Vol. 1, p. 418 (1933).
[1] P. C.
[2] Bennett, Chem. Formulary, Vol. 4, p. 420 (1939).
[3a] Ibid., Vol. 5, p. 533 (1939).

dissolved in 37 parts of boiling water. The mixture is cooled to 70°C. and 100 parts of a melted mixture containing 1 part of beeswax, 1 part of paraffin and 8 parts of ceresine added. Heating is continued for a half hour, the mixture is stirred well, the amount of water which has evaporated is replaced, and 96 parts of white spirit or turpentine substitute are gradually added. The whole is stirred until cool.[3b]

FORMULA No. 4.

Beeswax Yellow	5 lb.	Turpentine	3 gal.
Paraffin Wax	4 lb.	Salts of Tartar	1½ lb.
Soap Chips	3 lb.	Water	3½ gal.
Stearic Acid	3 lb.		

Dissolve salts of tartar and soap in boiling water. Melt waxes in another container and heat to 200°F. when the boiling water soap solution is added slowly with vigorous stirring until homogeneous. Turn off heat and run turpentine in slowly with good stirring. Pack in cans when cold.[4]

FORMULA No. 5.

Carnauba Wax	6.0	Oleic Acid	7.0
Beeswax	4.0	Triethanolamine	2.5
Ceresin	4.0	Water	75.0
Turpentine	70.0	Petroleum [5]	40.0
Trichlorethylene	2.0		

FORMULA No. 6.

Carnauba Wax	33	Soap	1
Beeswax	66	Water	10
Turpentine or White Spirit	225		

The soap is dissolved in water (hot) and the waxes are dissolved in the dipentene. When cool the solutions are mixed with vigorous shaking or stirring.[6]

3b Ibid.
4 Ibid., Vol. 1, p. 421 (1933).
5 Ibid., Vol. 4, p. 432 (1939).
6 P. C.

FORMULA No. 7.

Carnauba Wax #2	10	Triethanolamine	4
Candelilla Wax	10	Borax	1½
Oleic Acid	3	Water [7]	185

FORMULA No. 8.

Carnauba Wax	60 oz.	Caustic Soap	1½ oz.
Dry Castile Soap	oz.	Water to make	4 gal.
Oleic Acid	oz.		

Heat the wax, soap, and acid to 100°C. and while stirring rapidly add the caustic dissolved in the water, heated to 80°C., slowly.[8]

BRIGHT DRYING (RUBLESS) FLOOR POLISH EMULSIONS

FORMULA No. 1.

Carnauba Wax No. 2	120.0	Caustic Soda (47%)	3.5
Oleic Acid	13.7	Water	843.5
Trigamine	19.0		

Melt the wax in the oleic acid, add Trigamine and heat to 90°C. Then add the caustic soda and 25 cc. of water at about 95°C. Stir until jell is formed. Then add the rest of the water which must be boiling. Stir thoroughly till cool.[1]

FORMULA No. 2.

Carnauba Wax	120	Caustic Soda (50%)	8
Oleic Acid	20	Water	32
Trigamine	20	Water [2]	800

FORMULA No. 3.

Carnauba Wax	13.20	Water	108.00
Oleic Acid	1.50	Shellac	2.20
Triethanolamine	2.10	Ammonia (28%) [3]	0.32
Borax	1.00		

[7] P. C.
[8] P. C.
[1] Bennett, Chem. Formulary, Vol. 4, p. 419 (1939).
[2] Bennett, Chem. Formulary, Vol. 4, p. 419 (1933).
[3] Ibid., Vol. 1, p. 420 (1933).

FORMULA NO. 4.

Carnauba Wax No. 1	10 g.	Water	90	cc.
Ammonium Linoleate		Turpentine	1	cc.
Paste	g	Pine Oil		cc.
Borax	2 g.			

Heat the wax, turpentine and oil to 100°C. in a jacketed vessel fitted with a high speed stirrer. To this add slowly the paste, borax, and water previously heated to 100°C. Stir vigorously until emulsified.[4]

FORMULA NO. 5.

Carnauba Wax No. 1	20 g.	Ammonium Hydroxide		cc.
Ammonium Linoleate		Water	180	cc.
Paste		Ammonium Hydroxide		cc.

Heat the wax to 100°C. in a jacketed vessel fitted with a high speed stirrer and to it add slowly the paste, water and 7½ cubic centimeters of the ammonium hydroxide dissolved and heated to 80°C. As soon as emulsified add the balance of the ammonium hydroxide while stirring vigorously.[5]

FORMULA NO. 6.

Carnauba Wax	13.2	Shellac	2.0
Duponol G	2.0	Ammonia	0.3
Borax	1.0	Water	81.5

Melt together, in a steam jacketed vessel, the carnauba wax and Duponol G. While stirring efficiently, add the borax, dissolved in 1% of the water (boiling) and stir until homogeneous. After a homogeneous emulsion is formed turn off the steam and stir slowly until cooled to room temperature.[6]

FORMULA NO. 7.

a. Carnauba Wax	11.2	*b.* Shellac	1.5
Oleic Acid	2.4	Morpholine	0.2
Morpholine	2.2	Water	15.5
Water	67.0		

[4] Ibid., Vol. 2, p. 423 (1935).
[5] Ibid.
[6] E. I. du Pont de Nemours Co., Wilmington, Del.

Melt the carnauba wax carefully with the oleic acid and maintain the temperature closely at 90°C. Stir until well mixed, add the morpholine, and stir constantly until the whole mass is quite clear. In the meantime, the water should have been brought to a simmer in a separate kettle. Add it slowly to the hot wax mixture with steady stirring, making certain that each small portion is well incorporated before further addition. The mixture becomes increasingly viscous and should be of the appearance of petrolatum when two-thirds of the water has been added. After this stage has been reached, the mixture begins to thin out and the remainder of the water may be added rapidly. The total time for adding the water should be 30–40 minutes. A steam-jacketed kettle and a hand-operated paddle, or slow-speed, large-bladed propeller are recommended for successful production.

Allow the mixture to cool. While slowly stirring, add the shellac solution. This has been made by warming together the morpholine, water and shellac indicated in *b* above and filtering if necessary.[7]

FORMULA No. 8.

Carnauba Wax	64.8	Oleic Acid	15.3
Paraffin Wax	7.2	Boiling Water	430.0
Morpholine	14.4	Cold Water[8]	100.0

FORMULA No. 9.

1. Carnauba Wax No. 1 Yellow	30	Triethanolamine	3
Water	210	Oleic Acid	5

Melt the wax and the oleic acid in boiling water bath. When the mixture is homogeneous, add the triethanolamine and stir until it is all uniformly incorporated.

Heat the water to boiling and add it slowly, portion by portion, permitting each addition to be well agitated before

[7] Bennett, Chem. Formulary, Vol. 4, p. 418 (1939).
[8] Bennett, Chem. Formulary, Vol. 4, p. 419 (1939).

the next addition. As the first additions of water are made, the mixture thickens considerably and becomes gel-like in consistency. As more water is added, the mixture becomes like a cream. When still more water is added, it breaks into an emulsion and then becomes a watery product. During the gel and cream stage, it is very important that the addition of water be made carefully and efficient agitation be used in order to obtain a thoroughly homogeneous mass. It is just as detrimental to add the water too slowly as too fast. Equally as important as efficient agitation and careful addition of [illegible] is the maintenance of high temperatures during the [illegible]

[illegible]. Make a Manila resin solution as follows:

Manila DBB	30	Ammonium Hydroxide (28–29%)	12
Water	158		

Powder the resin and agitate it with water and the ammonia until all the resin is dissolved. Strain the solution.

3. Prepare the finished polish as follows:

Carnauba Wax Emulsion	34	Manila DBB Solution	39

Mix the two well, using stirring.[9]

FORMULA No. 10.

Paraffin Wax	15	Borax	Previously dissolved	7½
Oleic Acid	15	Water		7½
Triethanolamine				

Warm together to 90°C. and mix with an electric mixer. While keeping at 90–100°C. and stirring vigorously add the following which must be at 90–95°C.

Wax	100	Water

Cool quickly and package.[10]

9 Ibid., Vol. 5, p. 532 (1941).
10 [illegible]

FORMULA NO. 10a.

Carnauba Wax	30	Rosin	6

Heat above to 140°C., cool to 100°C. and add following with vigorous stirring which has been heated to 95–100°C.

Soap Flakes	10	Water [10a]	270
Turpentine	1		

FORMULA NO. 11.

Carnauba Wax No. 1 Yellow	30	Water	420
Thermally Processed Congo	30	Triethanolamine	4
Sodium Hydroxide	½	Oleic Acid	9

Melt the wax and add the Congo at about 125°–150°C. Hold until the mixture is homogeneous. Put the mixture in a boiling water bath. Add the oleic acid slowly and with vigorous stirring. Do the same with the triethanolamine. Dissolve the sodium hydroxide in 25 parts of water. Heat the solution to its boiling point and add it slowly to the mixture still in the boiling water bath, using vigorous stirring. When the mixture is thoroughly homogeneous, add the remainder of the water (also at its boiling point, and also with vigorous stirring).[11]

FORMULA NO. 12a.

"Rilan" Wax	10	Soda	2
Japan Wax	10	Water [12a]	100
Paraffin Wax	5		

FORMULA NO. 12b.

Montan Wax, Bleached	8	Potash	1
Soft Soap	2	Water [12b]	85
Rosin	1		

[10a] Bennett, Chem. Formulary, Vol. 1, p. 421 (1933).
[11] Ibid., Vol. 5, p. 532 (1941).
[12a] J. Davidsohn and A. Davidsohn, Shoe Creams & Polishing Waxes (1939).
[12b] Ibid.

FORMULA No. 12c.

Montan Wax, Bleached	5.6	Potash	1.5
Japan Wax	3.0	Water	55.0
Paraffin (50–52°C.)	4.0	Solvent[12c]	25–30
Curd Soap or Soft Soap	2.0		

FORMULA No. 12d.

35 parts spindle oil and 30 parts tall oil are mixed and warmed to about 70°C., then 8 parts of caustic soda solution, 38° Bé., is slowly added with constant stirring and boiled until saponification takes place. Then 25 parts of spindle oil, and 15 parts of kerosene are added as well as 5–10 parts of hot water.[12d]

FORMULA No. 12e.

Olein	5	Alcohol
Resin	6	

are melted together and mixed with good stirring at about 70°C. with 2.5 parts of caustic soda solution (38° Bé.). Then add and mix in turn.

Kerosene	70	Water[12e]	5–10
Turkey Red Oil			

FURNITURE POLISHES

FORMULA No. 1.

Bleached Beeswax	2	Stearic or Oleic Acid	3½
Carnauba Wax	6	Triethanolamine	1½
Halowax No. 1013	4	Water	63
Turpentine	20	Perfume	To suit

Melt the three waxes and add the turpentine with agitation. Prepare the soap solution by heating the triethanolamine dissolved in the water almost to the boil and adding the molten stearic acid or liquid oleic. The soap may also be pre-

Ibid.

J. Davidsohn and A. Davidsohn, Shoe Cream & Polishing Waxes (1939).

[12e] Ibid.

pared by heating the triethanolamine and water with acid in powdered form. Run the former solution into the latter with agitation. Continue to agitate until cool. If erly made the emulsion is

FORMULA No. 2.

Blendene	20	Varnolene	40
Spindle Oil	40	Water	120
Perilla Oil	20	Borax [2]	2

FORMULA No. 3.

Carnauba Wax	30	Naphtha	24
Beeswax	15	Stearic Acid	8
Ceresin Wax	15	Triethanolamine	4
Turpentine	26	Water [3]	65

FORMULA No. 4.

Carnauba Wax	10.0	Stearic Acid	8.0
Beeswax	4.0	Triethanolamine	4.5
Ceresin Wax	4.0	Water [4]	200.0
Naphtha	80.0		

FORMULA No. 5.

Carnauba Wax Bleached	6	White Curd Soap	3
Japan Wax	3½	Rosin, Pale	2
Paraffin Wax	1½	Water	30
Turpentine	12	Clove Oil [5]	Trace

FORMULA No. 6.

Carnauba Wax	6.0	Stearic Acid	1.0
Paraffin Wax	9.0	Trihydroxyethylamine	
Ceresin	2.0	Stearate	4.5
Naphtha	43.0	Water [6]	130.0
Turpentine	4.0		

FORMULA No. 7.

A. Carnauba Wax	60	B. Trihydroxethylamine	
Turpentine	60	Stearate	12
Stearic Acid	2	Water	62

[1] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).
[2] Ibid., Vol. 5, p. 534 (1941).
[3] Ibid., Vol. 1, p. 422 (1933).
[4] Ibid.
[5] Ibid.
[6] Bennett, Chem. Formulary, Vol. 1, p. 423 (1933).

Heat (A) and (B) in separate vessels to 200°F. and run (B) into (A) slowly with vigorous stirring. Stop when homogeneous.[7]

Formula No. 8.

Diglycol Stearate	10 oz.	Water	4 gal.
Paraffin Oil	3 pt.	Lemon Odor ("Lemenone")	2 oz.

The oil and diglycol stearate are heated together to 150°F. until the wax has melted. The hot wax mixture is then run into the water which has previously been heated to about 200°F. while stirring rapidly. Stirring should be continued until the batch has cooled. The lemon odor is added after the batch has partially cooled.[8]

Formula No. 9.

Light Mineral Oil	1 gal.	Carnauba Wax	2½ oz.

Heat until wax is dissolved.[9]

Formula No. 10.

Mineral Oil[10]	30 fl. oz.	Triethylamine	2 oz.
Kerosene	10 fl. oz.	Wood Alcohol	2 fl. oz.
	4½ fl. oz.	Water	60 fl. oz.
Stearic Acid	4½ oz.		

Mix the mineral oil, turpentine and kerosene, to the stearic acid and heat to about 148°F. to melt and dissolve the stearic acid. This should produce a clear solution.

In another container the triethylamine, alcohol and water are mixed and heated to 148°F. This mixture is then added to the first hot solution and stirred vigorously for 15 minutes to produce a smooth creamy and white emulsion. The stirring should be brisk. Care should be exercised in handling tur-

[7] Ibid.
[8] Crowley, Money Making Formulas.
[9] Bennett, Chem. Formulary, Vol. 1, p. 422 (1933).
[10] Crowley, Money Making Formulas.

pentine and kerosene because of their inflammability. Gentle stirring should be continued until the product is cool.

FORMULA NO. 11.

Naphtha	10	Nelgin	
Thin Mineral Oil	72	Water	
Perilla Oil	30		

Soak Nelgin in water for a few hours. Stir until dispersed. To this add oil mixture slowly with rapid stirring.[11]

FORMULA NO. 12.

Oleic Acid	2	2. Water	1¾
Kerosene	4	Sodium Hydroxide	1/20
Sulfonated Castor Oil	2	Triethanolamine	1/10

Mix 1 thoroughly. Mix 2 and pour into 1 while stirring at high speed. Continue to stir until batch is of uniform creamy consistency.[12]

FORMULA NO. 13.

Paraffin Oil	20	Gum Arabic	2
Red Oil	5	Water	70
Soft Soap	3		

The above are mixed vigorously until completely emulsified.[13]

FORMULA NO. 14.

Raw Linseed Oil	10	Xylol	5
Spindle Oil	50	Soft Soap	1
Stoddard Solvent	15	Water[14]	19

FORMULA NO. 15.

Spindle Oil	40 g.	Varnolene	120 cc.
Perilla Oil	20 g.	Water	120 cc.
Trigamine Stearate	30 g.	Borax	2 g.
Denatured Alcohol	10 cc.	Lemenone[15]	5 cc.

[11] Bennett, Chem. Formulary, Vol. 2, p. 421 (1935).
[12] Crowley, Money Making Formulas.
[13] Bennett, Chem. Formulary, Vol. 3, p. 287 (1936).
[14] Ibid.
[15] Ibid., Vol. 5, p. 534 (1941).

FORMULA No. 16.

Turpentine	8 gal.	Antimony Chloride	4 gal.
Naphtha	30 gal.	Gum Arabic	10 lb.
Lt. Spindle Oil	49 gal.	Gum Tragacanth	10 lb.
Acetic Acid (36%)	6 gal.	Perfume	1 gal.
Water	100 gal.		

Make up with water to 200 gallons and run through colloid mill.[16]

FORMULA No. 17.

Yellow Ceresine	3 lb.	Paraffin Oil (28°)	1 gal.
Japan Wax	1 lb.	Water	7 gal.
Beeswax	2 lb.	Carbonate of Potash	3 oz.
Linseed Oil, Raw	4 gal.	Soap Chips (Animal Fat Soap)	1 lb.
Turpentine	1 gal.		

Mix the above thoroughly.[17]

FORMULA No. 18.

Water	10	Acetic Acid	1/8
Nut Oil	1	Gum Arabic[18]	11
Mineral Oil	1		

FORMULA No. 19.

White Mineral Oil	2	Water	4
Kerosene	4	Perfume Oil	To suit
Sulfonated Castor Oil	1		

The kerosene and mineral oil are mixed and the sulfonated castor oil is added, while mixing vigorously. Next run in the water while mixing briskly. Finally add the perfume in the proportions of about ½ ounce to each gallon of polish.[19]

FORMULA No. 20.

a. Montan Wax, Double Bleached	4	*b.* Soft (Potash) Soap	1
Beeswax	5	Potassium Carbonate	3
		Water	82
		c. Ammonia (0.910)	5

[16] Ibid., Vol. 1, p. 422 (1933).
[17] Ibid.
[18] Bennett, Chem. Formulary, Vol. 1, p. 423 (1933).
[19] Crowley, Money Making Formulas.

Melt *a*, boil up with *b*, and stir until a smooth emulsion has formed. Cool. Add *c*.[20]

Formula No. 21.

Crude Montan Wax	5	Potassium Carbonate	3
Beeswax	4	Water [21]	87
Soft Soap	1		

Boil all ingredients together until a smooth emulsion has formed. Stir cold.

LEATHER POLISHES

Formula No. 1.

Carnauba Wax	5.0	Paraffin Wax	12.0
Montan Wax, Bleached	5.0	Potash	1.7
Beeswax	2.0	Water [1]	72.0
Japan Wax	1.0		

Formula No. 2.

Montan Wax, Bleached	10	Paraffin (50–52°C.)	13
Rosin	2	Potash	2½
Japan Wax	1	Water [2]	70
Diglycol Stearate	1		

Formula No. 3.

Carnauba Wax	12	Water	17–20
Stearin	3½	Turpentine [3]	12–15
Triethanolamine	1		

Formula No. 4.

Carnauba Wax	11	Triethanolamine	1
Turpentine	16	Water	66
Stearic Acid	3	Water Sol. Nigrosine [4]	1
Oil Soluble Nigrosine	2		

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[20] Bennett, Chem. Formulary, Vol. 5, p. 533 (1941).
[21] Ibid., p. 534.
[1] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.
[2] Ibid.
[3] Ibid.
[4] Bennett, Chem. Formulary, Vol. 1, p. 424 (1933).

FORMULA No. 5.

Water	20 gal.	Carnauba Wax	6 lb.
Potassium Oleate	7½ lb.	Turpentine	4½ gal.
Trisodium Phosphate	½ lb.	Pine Oil	½ gal.
Beeswax, Yellow	6 lb.	Terpineol[5]	¼ gal.

FORMULA No. 5a.

Mineral Spirits	169.00	Water solution of potassium hydroxide containing 1.65 parts of potassium hydroxide	19.25
Light Mineral Oil	187.50		
Glyceryl Monoricinoleate	93.60		
Ricinoleic Acid	11.03		
Water	624.75		

The potassium hydroxide solution and one-third of the total water are put in a mixing tank. The ricinoleic acid is then added and after the required stirring soap is formed by virtue of the action between the alkali and the fatty acid, the glyceryl mono ricinoleate is added followed by the mineral oil and in turn by one-half of the remaining water. Mineral spirits are added and finally the remaining water. The entire mixture after thorough agitation is then sent through an homogenizer to produce a commercial dispersion.[5a]

FORMULA No. 6.

Beeswax	1 lb.	Yellow Soap	6 oz.
Ceresin Wax	1 lb.	Oil Soluble Black	Enough to color
Carnauba Wax	6 oz.	Water	Sufficient
Turpentine	3 pt.		

Shave the soap and dissolve in the smallest possible quantity of water by means of heat, melt the waxes together, add the turpentine and stir well, then add the anilin dye and stir in the soap solution, continuing to stir until cold.[6]

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[5] Ibid., Vol. 2, p. 290 (1935).
[5a] U. S. 2,275,596.
[6] Bennett, Chem. Formulary, Vol. 1, p. 430 (1933).

FORMULA NO. 7.

Beeswax	100	*b.* Water	200
Paraffin Wax	20	Potassium Carbonate, Calcined	6
Carnauba Wax, Gray	8	Glue [7]	35
Naphtha	80		
Turpentine	70		

FORMULA NO. 8.

WAX MASS

Bleached Carnauba Wax	10.0 kg.	Pale Rosin	0.5 kg.
Japan Wax	5.0 kg.	Bleached Montan Wax	3.0 kg.
Bleached Beeswax	2.0 kg.	Stearin	0.5 kg.

SAPONIFYING SOLUTION

White Tallow Curd Soap	0.75 kg.	Water	35.00 kg.
Potassium Carbonate	1.50 kg.	Turpentine	1.00 kg.
Caustic Soda (36° Bé.)	0.25 kg.		

DYE SOLUTION FOR DARK REDDISH-BROWN CREAM
(per 100 kg. of above mass)

Brown R	350 g.	Tartrazine X	50 g.
Mars Red	250 g.	Final additional water	40 kg.[8]
Nigrosin G	15 g.		

FORMULA NO. 9.

Carnauba Wax	6	Lemongrass Oil	½
Ceresin Wax	3	Light Mineral Oil	1
Candelilla Wax	3	Diglycol Stearate	5
Turpentine	5		

Heat together below 90°C. and stir till clear. Pour slowly while stirring with high speed stirrer into

Water (Boiling)	100

Stir until temperature falls to 70°C.[9]

FORMULA NO. 10.

Carnauba Wax	25 g.	Triethanolamine	1 cc.
Ceresin	10 g.		

[7] Ibid., Vol. 4, p. 430 (1939).
[8] Ibid., p. 431.
[9] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

Melt together and stir; add following slowly:

Turpentine	30 cc.	Gasoline	30 cc.
Deodorized Kerosene	5 cc.		

For black polish add 1% oil black dye.

For brown polish add brown iron oxide sufficient to color.

The above mix is poured into cans at 25°C. and allowed to set.[10]

FORMULA No. 11.

Carnauba Wax	7.5	Potassium Carbonate	1.5
Marseilles Soap	1.0	Water	79.0

Melt the carnauba wax, and add the heated mixture of the other ingredients. Stir rapidly, and add 11 kg. nigrosine previously dissolved in a small amount of the soap solution.[11]

FORMULA No. 11a.

Carnauba Wax	30	g.	Stearic Acid	20	g.
Paraffin Wax	45	g.	Triethanolamine	7½	g.
Ozokerite	10	g.	Water	650	cc.
V.M.&P. Naphtha	215	cc.	Oil Soluble Black	15	g.
Turpentine	20	cc.	Water Soluble Black[1]	5	g.

FORMULA No. 11b.

Carnauba Wax	6	Lemongrass Oil	½
Ceresin Wax	3	Light Mineral Oil	1
Candelilla Wax	3	Diglycol Stearate	5
Turpentine	5		

Heat together below 90°C. and stir until clear. Pour slowly while stirring with high speed stirrer into

Water (Boiling)	100

Stir until temperature falls to 70°C. The finished product is snow white, applies easily and rubs to a high gloss. If

[10] Ibid., Vol. 2, p. 290 (1935).

[11] Ibid., Vol. 1, p. 429 (1933).

[11a] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

a paste polish is desired reduce the water to about 50 to 60 parts. If a colored paste is desired an aniline dye is dissolved in th

FORMULA No. 11c.

Pale Carnauba Wax	10.0	Potash	1.5
Japan Wax	4.5	Caustic Soda Solution	0.2
Bleached Montan Wax	3.0	Water	40.0
Rosin	0.5	Turpentine	2.0
Curd Soap	0.8	Water [11c]	30.0

FORMULA No. 11d.

Bleached Montan Wax	14	Potash	2½
Carnauba Residues	7	Water	75
Japan Wax	3	Turpentine [11d]	2

FORMULA No. 11e.

Pure Carnauba Wax	2.0	Curd Soap	0.7
Japan Wax	5.0	Potash	2.5
Carnauba Wax Residues	13.0	Water	40.0
Paraffin Wax	1.0	Water [11e]	25.0

FORMULA No. 11f.

Montan Wax	45	Potash	15
Beeswax	3	Water	300
Carnauba Wax	3	Curd Soap	2
Paraffin Wax (50-52°C.)	16	Water [11f]	70
Rosin	12		

FORMULA No. 11g.

Montan Wax	5.0	Paraffin Wax (50-52°C.)	1.5
IG Wax O. P.	2.5	Potash	1.5
IG Wax E.	1.0	Water	45.0
Japan Wax	0.5	Water [11g]	40.0
Rosin	1.5		

[11b] Ibid.
[11c] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.
[11d] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.
[11e] Ibid.
[11f] Ibid.
[11g] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

FORMULA No. 11h.

"Rilan" Wax	8.0	Rosin	0.5
1 S	5.0	Curd Soap	0.5
	7.0	Potash	0.5
Beeswax	3.0	Water	50.0
Paraffin Wax (50–52°C.)	7.0	Water [11h]	30.0

FORMULA No. 11i.

Carnauba Wax	12.50	Borax	0.75
Paraffin Wax (50–52°C.)	1.00	Potash	2.50
Ro	2.50	Water	50.00
Diglycol Stearate	1.50	Water [1]	25.00

FORMULA No. 11j.

Carnauba Wax	85	Triethanolamine	4
Stearin	9	Water	400

The stearin is melted down and the in hot water, is added at about 70°C. and then the whole stirred and heated to 100°C. Into this solution the melted carnauba wax, heated to 80–90°C. is stirred in, and the stirring continued until the whole mass has cooled.[11j]

FORMULA No. 11k.

Montan Wax, Bleached	20	Borax	
Japan Wax	7	Curd Soap	2
Carnauba Wax Residues	3	Water	40
Paraffin Wax (50–52°C.)	5	Turpentine or White Spirit [11k]	20
Rosin	2		
Potash	2		

FORMULA

Wax, Bleached	7.5	Curd Soap	1.5
Carnauba Wax Residues	12.0	Potash	1.0
Japan Wax	6.0	Water	40.0
Paraffin Wax	5.0	Water	5.0
Rosin	1.0	Ammonia (0.910)	0.5

0.5 parts of ammonia and 5 parts of water are only added after addition of the alkali lye and after putting in the emul-

[11h] Ibid.
[11i] John, White Shoe Dressings and Cleaners (1940).
[11j] John, White Shoe Dressings & Cleaners (1940).
[1k] Ibid

sifier. 20 parts of turpentine or of a solvent composition (as for example 10 parts turpentine and 10 parts white spirit) may be added.[11l]

FORMULA No. 11m.

Montan Wax, Bleached	6	Rosin	½
Carnauba Wax	3½	Curd Soap	½
Beeswax	3	Potash	¾
Japan Wax	2	Water	50
Paraffin Wax (50–52°C.)	4	Turpentine	28

FORMULA No. 12.

Mixture 1

Carnauba Wax	8	Paraffin Wax	4
Montan Wax	8		

These are saponified in a hot solution of

Potash	3	Water	50

Replace any evaporation with additional warm water.

Mixture 2

No. 1 Polish Black	4	Water	25

These should be milled together in a color mill until thoroughly dispersed.

While Mixture No. 1 is hot, add Mixture No. 2 slowly and with constant stirring. As it cools, the mass will slowly set to a paste. Before it is too stiff for flowing pour into suitable containers and set aside until cold.[12]

FORMULA No. 13.

Carnauba Wax	12.0	Sodium Nitrate	0.1
Rosin	0.5	Water [13]	To make 100.0
Triethanolamine Oleate	3.5		

[11l] Ibid.
[11m] John, White Shoe Dressings & Cleaners (1940).
[12] Bennett, Chem. Formulary, Vol. 1, p. 430 (1933).
[13] P. C.

FORMULA No. 14.

WAX MASS

Crude Montan Wax	10	Japan Wax	5
Beeswax	4	Shellac Wax	1¼
Carnauba Wax	1		

SAPONIFYING SOLUTION

Potassium Carbonate	1.5	Diglycol Stearate	1.0
Boiling Water	75.0	Palm Oil Soap	1.5
Borax	0.5		

DYE SOLUTION

Water	50	Final additional water 150 kg.[14]	
Nigrosin	5		

FORMULA No. 15.

Montan Wax Crude	4.00	Rosin	0.70
Japan Wax	0.30	Beeswax	0.30
Paraffin Wax (50°–52°C.)	1.00	Potassium Carbonate	1.15
Carnauba Wax Residue	2.00	Water	30.00
Carnauba Wax	0.50	Turpentine[15]	10.00

FORMULA No. 16.

Montan Wax, Crude	10.00	Soap, Castile	0.30
Montan Wax, Double		Sodium Tetraborate	0.30
Bleached	3.00	Nigrosine, Water Soluble	2.00
Rosin	2.00	Metanil Yellow Dye	0.08
Paraffin Wax (50/52°C.)	2.00	Water	95.00
Potassium Carbonate	2.20		

Pour at 65°C.[16]

FORMULA No. 17.

Montan Wax, Crude	15	Water	96
Paraffin Wax (40/42°C.)	20	Metanil Yellow	0.9
Rosin	5	Yellow Mandarin Dye,	
Potassium Carbonate	3	Water Soluble	0.8

Pour at 40–45°C.[17]

[14] Ibid., Vol. 4, p. 431 (1939).
[15] Bennett, Chem. Formulary, Vol. 4, p. 431 (1939).
[16] Ibid., p. 432.
[17] Ibid.

FORMULA NO. 18.

Montan Wax, Crude	15	Water	95
Paraffin Wax, Soft	20	Oil Soluble Color { Mandarin Yellow	1
Rosin	4–6	Oil Soluble Color { Metanil Yellow [18]	1
Potassium Carbonate	3		

FORMULA NO. 19.

WAX MASS

Crude Montan Wax	20.0	Paraffin Wax (50° to 52°C.)	10.0
Rosin	5.0		

SAPONIFYING SOLUTION

Potassium Carbonate	6.0	Water	60.0

DYE SOLUTION

Nigrosin T.	5.5	Final additional water [19]	50.0
Water	50.0		

FORMULA NO. 20.

Montan Wax (Bleached)	10	Paraffin Wax	5
Montan Wax (Crude)	5	Diglycol Stearate	3
Color L34	6	Soap (Powdered)	2
Candelilla Wax	4	Water	50
Carnauba Wax	2	Turpine	70

Melt the waxes, color and diglycol stearate together. Dissolve the soap in the water which must be boiling and add slowly with stirring to the melted waxes. When the temperature has fallen to 80°C. add the turpentine slowly with thorough agitation. Pour at 55°C.

For colors, use oil soluble colors dissolved in the waxes.[20]

FORMULA NO. 21.

1. Trihydroxyethylamine Stearate	25	Carnauba Wax	40
Beeswax	10	Turpentine	20
Candelilla Wax	30	2. Water [21]	500

[18] Ibid., Vol. 5, p. 536 (1941).
[19] Ibid., Vol. 4, p. 431 (1939).
[20] Bennett, Chem. Formulary, Vol. 4, p. 429 (1939).
[21] Ibid., Vol. 1, p. 428 (1933).

FORMULA No. 22.

Shoe Stain:

a.	Montain Wax Crude	15.0
	Rosin	2.0
	Paraffin Wax (40/42°C.)	3.0
	Potassium Carbonate	0.5
	Soap, Castile	4.0
	Water	65.0
b.	Shellac	20.0
	Sodium Tetraborate	7.0
	Water	75.0
c.	Nigrosin, Water Soluble	5.5
	Water	25.0

a, b, c, are prepared separately and then mixed together.[22]

FORMULA No. 23.

a.	Vandyke Brown	8	lb.
	Raw Umber	30	lb.
	Casein Solution	4½	gal.
	Water	1¼	gal.
	Tragacanth Solution	½	
b.	Water		gal.
	Caustic Soda		lb.
	Castile Soap	2	lb.
	Gray Carnauba Wax	6	lb.
	Black Montan Wax	3	lb.
	Nigrosine	6	oz.
	Rogers Fish Glue[23]	1½	gal.

Mix solutions of *a* and *b*.

FORMULA No. 24.

a.	Burnt Turkey Umber	20	lb.
	Indian Red	3	lb.
	Middle Chrome	2	lb.
	Casein Solution		gal.
	Garnet Shellac Solution		gal.
b.	Water	6¾	gal.
	Castile Soap	1	lb.
	Gray Carnauba Wax	5¼	lb.
	Water Brown Dyestuff	1½	oz.

These two finishes are made in sections as above, the pigment paste being added to the wax solution either hot or cold. Usually no dyestuff is necessary, but for these darker shades, a trace of nigrosine or dark brown color is advisable. Both finishes are full bodied and will stand considerable dilution with either cold water or casein solution.[24]

[22] Ibid., Vol. 4, p. 432.
[23] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes (1939).
[24] Ibid.

FORMULA No. 25.

Water	1 gal.	Carnauba Wax	2½ lb.
Nigrosine	3 oz.	Nigrosine Stearate	¼ lb.
Ethanolamine	¼ lb.	Turpentine	
Stearic Acid	¾ lb.	Clove Oil	

The wax is melted in one container and diluted with the solvents and then vigorously stirred into the second receptacle with the boiling soap and alkaline solution.[25]

FORMULA No. 26.

a. Crude Montan Wax	18	*b.* Water	260
Japan Wax	2	Potash (98%)	6
Carnauba Wax	4	Water-Soluble Nigrosin	12
Rosin			

Heat A and B separately to 95–100°C. and add B to A while stirring vigorously with an electric mixer.[26]

FORMULA No. 27.

BLACK BOTTOM GLOSS

Water	1 gal.	Japan Wax	2 lb.
Potassium Oleate	6 oz.	Turpentine	½ gal
Nigrosine	¾ lb.	White Spirit	½ gal
Paraffin Wax	2 lb.	Cassia Oil	5 oz.
Black Montan Wax	3½ lb.		

These brown and black glosses are prepared in the same way as the white gloss: the waxes and solvents being mixed separately and added to the tinted boiling water.[27]

FORMULA No. 28.

BROWN BOTTOM GLOSS

Water	1 gal.	Turpentine	2 gal
Castile Soap	3½ oz.	Terpineol	½ pt.
Potassium Carbonate	1½ oz.	No. 62995 Water Brown Dyestuff[28]	1½ oz.
White Montan Wax	3 lb.		
Yellow Beeswax	3 lb.		

25 Ibid.

26 Bennett, Chem. Formulary, Vol. 1, p. 430 (1930).

27 J. Davidsohn & A. Davidsohn, Shoe Creams & Polishing Waxes (1939).

28 Ibid.

Formula No. 29.

"NATURAL" BOTTOM FINISH

a. Titanox or Lithopone	14	lb.	*b.* Water	16	gal.
China Clay	13	lb.	Soap	3½	lb.
Yellow Ochre	10	lb.	Gum Arabic	6	lb.
Casein Solution	4	gal.	Yellow Carnauba Wax	10¾	lb.
Bleached Shellac Solution	2	gal.	Fish Glue [29]	7	pt.

Formula No. 30.

PALE PINK BOTTOM FINISH

a. Pale Buff (No. 8102 Pigment)	6	lb.	*b.* Water	1½	gal.
Bleached Shellac Solution	1	gal.	Gum Tragacanth	1	qt.
Water	3	pt.	Potassium Oleate	¼	lb.
			Yellow Carnauba Wax	1¾	lb.
			Fish Glue [30]	3	pt.

Formula No. 31.

SHOE INK

Water	12	gal.	Carnauba Wax	6	lb.
Logwood Extract	1¼	gal.	Beeswax	2	lb.
Gum Arabic	¾	lb.	Ferrous Sulphate [31]	1¼	lb.
Soft Soap	1¼	lb.			

Formula No. 32.

MODERN TRANSPARENT HEEL AND EDGE FINISH

Water	1½	gal.	Gum Tragacanth	¾	oz.
Borax	1	oz.	Castile Soap	3	oz.
T.N. Shellac	4	oz.	Gray Carnauba Wax	¾	lb.
Brown Water Dyestuff	6½	oz.			

The ingredients are boiled together until solution is complete and to prevent any separation of the wax, the whole is cooled down as quickly as possible with constant stirring.[32]

[29] Ibid.
[30] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes (1939).
[31] Ibid.
[32] Ibid.

FORMULA NO. 33.

DARK BROWN HEEL AND EDGE STAIN

SOLUTION NO. 1

Water	1¼ gal.	Dark Brown Dyestuff	12 oz.
Borax	½ oz.	Lactic Casein	¾ lb.
Ammonia (0.880)	½ oz.		

SOLUTION NO. 2

Water	1¼ gal.	Shellac Wax	1½ lb.
Sodium Stearate	5 oz.	Nigrosine	1 oz.
Algin	2½ oz.		

Solution No. 1 is prepared and allowed to become quite cold. Solution No. 2 is boiled until all the wax has emulsified and the cold dark brown dye solution is stirred into it rapidly. This prevents the separation of any wax when the finish is cold.[33]

FORMULA NO. 34.

"NATURAL LEATHER" BOTTOM STAIN

Prepare three solutions as follows and allow the first two to become cold:

a. Gum Tragacanth (Powdered)	2 oz.	*c.* Castile Soap	3½ oz.
Methylated Spirits	4 oz.	Yellow Carnauba Wax	17 oz.
Water	1 gal.	Water	1 gal
b. Garnet Shellac	2 lb.	Primrose Yellow Dyestuff	½ oz.
Borax	½ lb.		
Water	1 gal.		

When solution *c* is boiling rapidly stir in 1 quart each of the tragacanth and shellac solutions, and cool the whole off rapidly.[34]

[33] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.
[34] Ibid.

Formula No. 35.

BROWN BOTTOM FINISH

a. Raw Umber	35	lb.	*b.* Soft Water	10	gal.
Chrome Yellow	5	lb.	Tragacanth Solution	1	gal.
Garnet Shellac Solution	4	gal.	Sodium Stearate	1¼	lb.
Water	2	gal.	Gray Carnauba Wax	7¼	lb.
			Liquid Fish Glue [35]	¾	gal.

Formula No. 36.

LIGHT BROWN RUSSET FINISH

a. Turkey Umber	10	lb.	*b.* Water	3	gal.
Kaolin	4	lb.	Ammonium Linoleate	¾	lb.
Chrome Yellow	2	lb.	Gray Carnauba Wax [36]	2¾	lb.
Bleached Shellac Solution	1½	gal.			
Casein Solution	1	gal.			
Water	½	gal.			

Formula No. 37.

"BEND" COLOURED BOTTOM FINISH

a. Yellow Ochre	6	lb.	*b.* Water	7	gal
Lemon Chrome	3	lb.	Shellac Solution	2½	gal
Titanox or Kaolin	16	lb.	Castile Soap	1½	lb.
Water	2	gal.	Carnauba Wax	6¼	lb.
			Fish Glue [37]	5½	pt.

Formula No. 38.

WAX RUSSET FINISH (BUFF)

a. Soft Water	8	gal.	*b.* Soft Water	5	gal
Castile Soap	3	lb.	China Clay	40	lb.
Fish Glue	10	lb.	Yellow Ochre	10	lb.
Yellow Carnauba Wax	6	lb.	Red Oxide	3	lb.
Japan Wax	2	lb.	Citronella Oil [38]	1½	lb.

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[35] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

[37] Ibid.

[38] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

Formula No. 39.

BROWN RUSSET STAIN

Soft Water	3¼ gal.	Borax	½ lb.
Farina	5 oz.	Orange Shellac	2 lb.
Castile Soap	½ lb.	Burnt Turkey Umber	15 lb.
Fish Glue	3½ pt.	Boiled Linseed Oil	2½ pt.
Yellow Carnauba Wax	1¼ lb.	Sassafras Oil	½ pt.

This finish is prepared in two parts, the water being divided up as above, and the wax emulsion added to the colour paste: the whole is then passed once or twice through a paint grinding mill.[39]

Formula No. 40.

"NATURAL LEATHER" FINISH

Soft Water	7 gal.	Fish Glue	3 qt.
Irish Moss	¼ lb.	China Clay	34 lb.
Castile Soap	½ lb.	Flake White	8 lb.
Yellow Carnauba Wax	2¼ lb.	Middle Chrome	3½ lb.
Borax	½ lb.	Citronella Oil	1½ pt.
T.N. Shellac	2 lb.		

The wax and glue solution is prepared by boiling all the ingredients together, and then cooling down as quickly as possible so that there is no separation of the waxes. The earth pigments are ground up into a stiff paste with the water and the citronella oil, and the wax emulsion added to it: the whole is then passed through a paint mill.[40]

Formula No. 41.

RED-BROWN HEEL AND EDGE FINISH

Make two solutions of shellac and casein containing the equivalent of 2 lb. and 1 lb. of each per gal., using borax and ammonia as described in the preceding formulae. Mix one pint of each together to form a stiff jelly.

[39] Ibid.
[40] Ibid.

Prepare a colored wax solution as follows:

Water	3½ pt.	Brown Dyestuff	3½ oz.
Castile Soap	2½ oz.	Gray Carnauba Wax	10 oz.
Caustic Soda	½ oz.		

and when boiling stir in the cold casein-shellac jelly; cool down as rapidly as possible.[41]

FORMULA No. 42.

WHITE BOTTOM GLOSS

Water	1 gal.	Carnauba Wax	8 lb.
Trihydroxyethlamine Stearate	2 lb.	Stearic Acid	¼ lb.
		Turpentine	1½ gal

This gloss can be prepared in the same way as the preceding one or alternatively in two pans; the wax, stearic acid and turpentine are melted and mixed together and then rapidly stirred into the boiling water and trihydroxyethylamine stearate.[42]

FORMULA No. 43.

WHITE BOTTOM CREAM

Water	3 gal.	Dekalin	2½ gal
Potassium Stearate	¾ lb.	Turpentine	2½ gal
Beeswax	6 lb.	Clove Oil[43]	5 oz.
Yellow Carnauba Wax	6 lb.		

FORMULA No. 44.

BROWN BOTTOM CREAM

Water	3 gal.	Turpentine	5 gal
Pearl Ash	½ lb.	Lavender Oil	½ lb.
Potassium Stearate	¼ lb.	Wax Brown Dyestuff	½ oz.
White Beeswax	9 lb.	Orange II.[44]	⅛ oz.
Yellow Carnauba Wax	3 lb.		

[41] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

[43] Ibid.

[44] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

FORMULA No. 45.

ONE SETTING EDGE INK

(a)	Soft Water	5 gal.	(c)	Casein Solution (1¼ lb. per gal.)	
	Ammonium Linoleate	1¾ lb.		Ammonia	½ pt.
	Gray Carnauba Wax	8 lb.			
	Japan Wax	2 lb.			
(b)	Soft Water	10 gal.			
	Borax	1¼ lb.			
	Bleached Hank Lac	5 lb.			
	Nigrosine	16 lb.			

The shellac-nigrosine solution is prepared by boiling and is allowed to become quite cold. The wax emulsion is boiled for half-an-hour and the dye solution added rapidly with vigorous stirring; the casein is then poured in slowly and the agitation continued until the ink is quite

FORMULA No. 46.

COMBINED INK FOR BOTTOMS, HEELS AND EDGES

Soft Water	35 gal.	Caustic Soda	3 lb.
Irish Moss	2½ oz.	Gray Carnauba Wax	16 lb.
Borax	2 lb.	Fibre Wax	8½ lb.
Garnet Shellac	8 lb.	Nigrosine	42 lb.
Castile Soap	3 lb.		

The water is brought to the boil and the ingredients are added in the order indicated. (Care must be taken with the caustic soda, to add only small amounts at a time.) When the whole is completely in solution, the heat is taken away and the ink cooled down quickly by running cold water through the jacketed pan, mechanical stirring being maintained the whole time.[46]

[45] Ibid.
[46] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

FORMULA NO. 47.

GENERAL INK

Soft Water	35 gal.	Black Montan Wax	12 lb.
Irish Moss	5½ oz.	Gray Carnauba Wax	4 lb.
Borax	1½ lb.	Fibre Wax	8 lb.
Garnet Shallac	6 lb.	Nigrosine	38 lb.
Castile Soap	3½ lb.	Metanil Yellow	2 lb.
Caustic Soda	2¾ lb.		

FORMULA NO. 48.

ONE SETTING EDGE INK

Water	5 gal.	Carnauba Wax	¾ lb.
Borax	5 oz.	Nigrosine	4¾ lb.
Bleached Shellac	1¼ lb.	Metanil Yellow	4 oz.
Caustic Soda	½ lb.	Ammonia	5 oz.
Black Montan Wax	2¾ lb.		

FORMULA NO. 49.

POLISHING INK

a. Water	80.0	*b.* Water	20.0
Marseilles Soap	3.0	Methyl Cellulose	1.0
Carnauba Wax	4.0	*c.* Turpentine Oil	1.0
Japan Wax	2.0	Citronella Oil	0.3

Boil the mixture *a,* when cooled, add the dispersion *b* which has been boiled separately. When cooled, add *c.*[49]

FORMULA NO. 50.

QUICK BLACK

Soft Water	8 gal.	Caustic Potash	½ lb.
Castile Soap	1½ lb.	Nigrosine[50]	8 lb.
Gray Carnauba Wax	6½ lb.		

[47] Ibid.
[48] Ibid.
[49] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).
[50] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

Formula No. 51.

QUICK BLACK

Prepare 4 gals. of tragancanth solution by dissolving ½ lb. of the powdered gum in 4 gal. water.

Water	10 gal.	Nigrosine	15½ lb.
Tragacanth Solution	4 gal.	Metanil Yellow Dyestuff	6 oz.
Caustic Soda	2½ lb.	Ammonia (added when cold)[51]	8 oz.
Castile Soap	1 lb.		
Gray Carnauba Wax			

Formula No. 52.

QUICK BLACK

Soft Water	12½ gal.	Nigrosine	12 lb.
Ammonium Linoleate	1½ lb.	Ammonia[52]	3 oz.
Yellow Carnauba Wax	lb.		

Formula No. 53.

QUICK BLACK

Prepare a casein solution by dissolving 2½ lb. casein in 2 gals. of hot water with the aid of 3½ oz. ammonia (.880).

(a) Water	3 gal.	(b) Water	4 gal.
Metanil Yellow	¼ lb.	Castile Soap	1¼ lb.
Nigrosine	8½ lb.	Gray Carnauba Wax	7 lb.
Casein Solution	2 gal.		

The nigrosine-casein mixture is prepared separately and allowed to become quite cold. The wax is boiled until in solution and the cold dye added quickly to cool it down. Stirring is continued until the whole is quite cold.[53]

[51] Ibid.
[52] Ibid.
[53] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

FORMULA No. 54.

QUICK BLACK

(a) Water	6 gal.	(b) Water	4½ gal.
Borax	1¼ lb.	Tragacanth Solution	1 gal.
Garnet Shellac	5 lb.	Castile Soap	1¾ lb.
Metanil Yellow	6 oz.	Gray Carnauba Wax	12 lb.
Nigrosine	14 lb.	Ammonia (added cold)	4 oz.

This ink is prepared with two solutions, the cold dye being added to the boiling wax to cool it down.[54]

FORMULA No. 55.

ONE SETTING EDGE INK

Water	12¾ gal.	Gray Carnauba Wax	
Borax	1 lb.	Tragacanth Solution	6¼ gal.
Bleached Shellac	4½ lb.	Metanil Yellow	¼ lb.
Caustic Soda	2½ lb.	Nigrosine	18 lb.
Castile Soap	1¼ lb.		

Boil the ingredients together in the order indicated, and cool down rapidly with continuous agitation. When cold add

Aniseed Oil, dissolved in	1¼ oz.	Methylated Spirits[55]	½ gal.

FORMULA No. 56.

HEAVY INK FOR SPONGY LEATHERS

(a) Water	4 gal.	(b) Water	4 gal.
Metanil Yellow	5 oz.	Tragacanth Solution	1 gal.
Nigrosine	11¼ lb.	Castile Soap	2 lb.
Casein Solution (2½ lbs. to 2 gallons)	1½ gal.	Gray Carnauba Wax	10½ lb.

The two solutions are prepared separately and the cold dye solution added to the emulsified wax.[56]

[54] Ibid.
[55] Ibid.
[56] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

FORMULA NO. 57.

QUICK BLACK

(a) Soft Water	25 gal.	(b) Soft Water	10 gal.
Borax	2 lb.	Ethanolamine	2 lb.
Garnet Shellac	8 lb.	Stearic Acid	6 lb.
Nigrosine	40 lb.	Yellow Carnauba Wax	30 lb.
Metanil Yellow	2 lb.	Black Montan Wax [57]	2 lb.

FORMULA NO. 58.

BURNISHING INK

Paraffin Wax	3.0	Nigrosin, Water-Soluble	2.4
Carnauba Wax	3.0	Soda Ash, Calcined	3.0
Japan Wax	6.0	Water [58]	76.6
Rosin	6.0		

FORMULA NO. 59.

GLOSS INK

a. Montan Wax, Crude	15	*b.* Shellac	20
Colophony	2	Borax	7
Soft Paraffin 40/42°C.	3	Water	75
Potash Carbonate	½	*c.* Nigrosine NTL	5½
Marseilles Soap	4	Water	25
Water	65		

Make up separately *a*, *b*, and *c*, and mix these three components together.[59]

WHITE SHOE POLISHES

FORMULA NO. 1.

Titanium Dioxide (Water dispersing grade)	15.0	Japan Wax	1.0
Pine Oil	1.0	Oleic Acid	0.5
Sodium Alginate	0.3	Triethanolamine	0.5
Gum Arabic	1.0	Water	79.7
Carnauba Wax	1.0	Preservative	q.s.

The pine oil is emulsified with a small portion of the oleic acid and triethanolamine and the pigment wet thoroughly

[57] Ibid.
[58] Bennett, Chem. Formulary, Vol. 4, p. 183 (1939).
[59] Davidsohn & Davidsohn, Shoe Creams & Polishing Waxes.

with this emulsion. The sodium alginate is dissolved in a small part of the water and added to the pigment mix. The gum arabic is dissolved by heating to about 180°F. (on a water bath), with a small amount of water. When the gum arabic is completely dissolved, it is cooled to room temperature and added to the pigment mix. The waxes are heated with the remaining amounts of oleic acid and triethanolamine to the melting point (about 185°F.) of the carnauba wax and then a sufficient amount of water (boiling hot) is added while stirring vigorously. Stirring should be continued for about ten minutes or until a smooth emulsion is formed. This emulsion is cooled to room temperature with slight agitation.[1]

FORMULA NO. 2.

WHITE BOTTOM GLOSS

Yellow Carnauba Wax	3½ lb.	White Spirit	½ gal.
Beeswax	1¼ lb.	Ethanolamine	¾ lb.
Japan Wax	1 lb.	Stearic Acid	1½ lb.
Ceresine Wax	½ lb.	Water	1 gal.
Turpentine	½ gal.		

The waxes, stearic acid and the ethanolamine are melted together in a steam jacketed pan and the mixture of turpentine and white spirit added slowly so that there is no precipitation of the waxes. The water is boiled and stirred into the other melted components.[2]

FORMULA NO. 3.

WHITE GLOSS

Soft Water	½ gal.	Turpentine	½ gal.
Castile Soap	¾ lb.	Raw Linseed Oil or	
Yellow Carnauba Wax	3 lb.	Mineral Oil	½ pt.

The water and soap are boiled together until a clear solution is obtained; the wax is melted in the second pan and

[1] John, White Shoe Dressings and Cleaners (1940).
[2] John, White Shoe Dressings & Cleaners (1940).

the turpentine and oil added to it. The wax solution is then rapidly transferred to the boiling water with constant stirring. The whole rapidly thickens to a creamy paste, which when cold is packed into one pound tins by the aid of a flat spatula. To obtain a smooth lustrous appearance the tin is then passed under a flat hot plate.[3]

FORMULA No. 4.

WHITE KID CLEANER

a. Carnauba Wax, Gray	50 g.	*b.* Turpentine	150 cc.
Montan Wax, Bleached	50 g.	Benzene	100 cc.
Paraffin Wax (50/52°C.)	20 g.	Trichlorethylene	150 cc.
Japan Wax	20 g.	Acetone	50 cc.
Rosin	15 g.		
Diglycol Stearate	10 g.		
Potassium Carbonate	32 g.		
Water	600 g.		

Boil *a* together with stirring, until a homogeneous emulsion has been formed. Cool to 40°C., and add the solvents *b*. Stir until cooled.[4]

FORMULA No. 5.

WHITE SHOE CLEANER

Titanium Dioxide	5	Petroleum Naphtha	13
Lithopone	15	Triethanolamine Stearate	2
Dammar	4	Water	51
Carbon Tetrachloride	10		

Dammar resin is dissolved in the petroleum naphtha and the solution is strained to remove undissolved matter. The triethanolamine stearate is dissolved in warm water. After cooling, the resin solution is stirred into the water solution, using vigorous agitation because an emulsion is being made and additions must be slow. When the emulsion is smooth,

[3] Ibid.
[4] Bennett, Chem. Formulary, Vol. 4, p. 428 (1939).

the carbon tetrachloride is stirred in followed by the pigments.[5]

METAL POLISHES

Formula No. 1.

2 parts of fatty acids from tallow or from hardened fat, 8 parts of talloil, 5 of petroleum and 5 of denatured alcohol are treated with 5 parts of ammonia, sp. gr. 0.91, for saponification of the fatty acids. To this is added 45 parts of water and then a mixture of 5 parts of bentonite and 25 parts of amorphous silica. This product is rather viscous and settles out only slowly.[1]

Formula No. 2.

Gum Tragacanth	0.20	Glycerin	5.65
Water	63.15	Diatomaceous Earth	12.25
Alkali Metal Salt of a Sulphated Alcohol Having More Than 8 Carbon Atoms (Wetanol)	0.50	Neutral Oil (Mineral)	17.00
		Amyl Acetate	0.25
		Formaldehyde [2]	1.00

Formula No. 3.

Kieselguhr	5.0	Red Oil	2.0
Silica Dust	4.0	Triethanolamine	0.5
Ferric Oxide	4.0	Ammonia (26° Bé.)	1.5
Naphtha	19.0	Water	54.0
Kerosene	10.0		

The oleic acid is first mixed with the kerosene and naphtha, the abrasives then being stirred in. Stirring is continued while the ammonia and triethanolamine solution is added. If desired, the proportion of water may be increased by about another 10%.[3]

[5] Bennett, Chem. Formulary, Vol. 5, p. 535 (1941).
[1] Ibid., p. 526.
[2] P.C.
[3] Bennett, Chem. Formulary, Vol. 5, p. 526

FORMULA NO. 4.

Naphtha	62	Triethanolamine	
Oleic Acid	1	Ammonia (26°)	1
Abrasive	7	Water	128

FORMULA NO. 5.

a. Oleic Acid or Talloil, Distilled	20	*b.* Alcohol	16
Benzine	14	Ammonia (0.960)	13
Methylhexalin	2	*c.* Kieselguhr, Finest	35

Add the mixture *b* to the solution *a* with agitation. Work in *c*.

Let stand overnight. Strain.[5]

FORMULA NO. 6.

1. Naphtha	60	4. Ammonia	2–3
Oleic Acid Distilled	5	5. Clay	1
2. Triethanolamine	2	Tripoli	11
Water	125	Aluminum Oxide	77
3. Naphtha	5		

To the solution 1 add with good agitation the solution 2. When emulsified, add 3, 4, and finally the mixture 5 to get a paste.[6]

FORMULA NO. 7.

a. Soft Soap	30	*e.* Kieselguhr	20
b. Turpentine	10	Emery	20
c. Alcohol	5	Chrome Oxide	5
d. Water	10		

Thin *a* with *b, c, d* in the given order; work in *e*.[7]

FORMULA NO. 8.

a. Oleic Acid or Talloil	5	*d.* Whiting	10
Turpentine	15	Emery	20
b. Ammonia	3	Glass, Powdered	10
c. Water	30	Graphite Dust	7

[4] Ibid., Vol. 1, p. 426 (1933).
[5] Ibid., Vol. 4, p. 412 (1939).
[6] Ibid., p. 437.
[7] Bennett, Chem. Formulary, Vol. 4, p. 409 (1939).

To the solution *a* add *b* with good agitation. Thin with *c*. Work in *d* to get a paste.[8]

FORMULA No. 9.

Water	480.0	Silica	180.0
Suspendite	15.0	Solvent Naphtha	13.6
Ammonium Laurate S	40.0	Ammonia (26°)	22.4

The Suspendite is added to warm water with stirring until smooth. The ammonium laurate S is added with stirring and then the silica. Under rapid agitation this should take about 10–15 minutes. Then add the naphtha with continued stirring and finally the ammonia.

The consistency of the polish can be varied by varying the amounts of the different ingredients.[9]

FORMULA No. 10.

Ammonium Linoleate R.	20	Naphtha V. M. & P.	10
Oxalic Acid	2	Silica	60
Ammonia	4	Alcohol	5
Water	150		

Heat the water to 70°C. Dissolve the oxalic acid, add the silica and stir until dispersed. Add the ammonia and stir for a few minutes keeping at 70°C. Then add the ammonium linoleate R. and stir until dissolved. Add the naphtha slowly and stir. The mixture becomes very heavy. The alcohol is then added slowly until the desired body and viscosity are obtained.[10]

FORMULA No. 11.

Ammonium Linoleate R.	20	Alcohol
Naphtha V. M. & P.	100	Ammonia
Silica	40	

Heat the naphtha cautiously to 60°C. Dissolve the ammonium linoleate R. and disperse the silica. Add the ammonia

[8] Ibid.
[9] Ibid., Vol. 5, p. 526 (1941).
[10] Ibid., Vol. 4, p. 408 (1939).

when the mixture becomes very heavy. It is then thinned down as desired by the addition of the alcohol.[11]

FORMULA No. 12.

a. Ammonium Linoleate	9	*c.* Whiting	40
Turpentine	20	Chrome Oxide	5
b. Alcohol	4		
Water	22		

Mix *a,* which has been previously heated to about 50°C. with *b,* adding the latter with good agitation; work in *c.*[12]

FORMULA No. 13.

a. Soft Soap	20	*b.* Water	15
Turpentine	15	*c.* Whiting	35
Alcohol	5	Yellow Ochre	10

Make solution *a,* add *b,* and when homogeneous, use to make a paste with *c.*[13]

FORMULA No. 14.

Tripoli	1¼ lb.	Sodium Hydroxide (Sticks)	½ oz.
Pine Oil (Steam Distilled)	1½ pt.	Water	3 pt.
Oleic Acid	7 fl. oz.		

Mix the pine oil and oleic acid. Dissolve the sodium hydroxide in the water and run this mixture into the oil while mixing. Mixing should be continued for about 5 minutes. The tripoli is finally added and thoroughly mixed in. This metal polish is applied with a soft cloth.[14]

FORMULA No. 15.

Stearic Acid	10	Alcohol	
Naphtha	30	Mixture of Clay,	
Caustic Potash (30° Bé.)	5	Tripoli 1:4	To make paste

[11] Bennett, Chem. Formulary, Vol. 4, p. 409 (1939).
[12] Ibid.
[13] Ibid.
[14] Crowley, Money Making Formulas.

To the naphtha-stearic acid solution add the alkali, then the alcohol. Work into a paste with the minerals.[15]

FORMULA No. 16.

Potassium Hydroxide	40 g.	Alcohol	25 cc.
Water	900 cc.	Ethylene Dichloride	50 cc.
Olive Elaine	150 cc.		

Add the potassium hydroxide to the water, warm to 75°C. and slowly stir in the olive Elaine until completely dissolved. Cool and add the alcohol and ethylene dichloride.[16]

FORMULA No. 17.

1. Ortho Dichlorbenzol	5	Tripoli or Silex	50–75
Naphtha or Mineral Spirits	20	Suspendite	9
Pine Oil	4	Water	260
2. Trihydroxyethylamine Linoleate	2	3. Ammonium Hydroxide	12

Add "1" to "2" with stirring and then stir in "3"; allow to stand overnight and stir before packaging.

This gives a polish which does not separate if made properly. If a thicker polish or paste is desired the Tripoli is increased and the liquids decreased.[17]

FORMULA No. 18.

Dissolve 5 parts curd soap in 40 parts water, adding 20 parts of a 5 per cent methyl cellulose slime. Then add 15 parts kieselguhr, 10 parts tripoli, and 10 parts denatured alcohol.[18]

FORMULA No. 19.

Tripoli	20.0	Yarmor	25.0
Oleic Acid	7.0	Water[19]	47.5
Sodium Hydroxide (100%)	.5		

[15] Bennett, Chem. Formulary, Vol. 4, p. 411 (1939).
[16] Ibid., Vol. 3, p. 284 (1936).
[17] Ibid., Vol. 1, p. 426 (1933).
[18] P. C.
[19] Ibid., Vol. 1, p. 425 (1933).

FORMULA No. 20.

a. Ammonium Linoleate	6	*c.* Calcium Carbonate	40
Benzine	16	Pigment (e.g. Ultramarine)	10
b. Water	28		

Make emulsion by adding *b* to *a* with stirring. Work into this the fine powder *c*.

Nos. 1 and 2 are for tin cans, No. 3 is for collapsible tubes.[20]

FORMULA No. 21.

a. Ammonium Linoleate	9	*b.* Emery	20
Turpentine Substitute	16	Whiting	25
Alcohol	2	Glass Powder	10
		c. Water	18

Mix *a*, and wet thoroughly *b* in this oil-solvent mixture. Add *c* to the whole with thorough agitation and in small portions.[21]

FORMULA No. 22.

a. Ammonium Linoleate	25	*b.* Whiting	15
Water	40	Quartz Flour	10
		Chromium Oxide[22]	10

FORMULA No. 23.

a. Soft Soap	15	*d.* Green Earth	10
Methyl Cyclohexanol	2	Whiting	10
b. Turpentine	15	Pumice Meal	10
c. Ammonia (0.910)	5	Emery	10
Water	23		

Stir together *a* and *b*, add *c* with good agitation. Now add the powders *d*, mixing very thoroughly.[23]

FORMULA No. 24.

a. Oleic Acid	15	*b.* Ammonia (0.910)	5
Mineral Oil, White	10	*c.* Chrome Oxide	25
Alcohol	45		

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[20] Bennett, Chem. Formulary, Vol. 4, p. 413 (1939).
[21] Ibid., p. 412.
[22] Ibid.
[23] Ibid.

Emulsify adding *b* to *a* with stirring. Work in *c* with thorough agitation.[24]

FORMULA No. 25.

a. Diglycol Stearate	6	*c.* Kieselguhr	14
Water	66	Iron Oxide Red	6
b. Oleic Acid	5	*d.* Ammonia (0.910)	3

Mix *b* with the hot solution *a*. Work in the abrasives *c*, and saponify with *d*. Mix thoroughly, and allow to stand overnight. Strain.[25]

FORMULA No. 26.

a. Diglycol Laurate	8	*c.* Kieselguhr, Calcined	20
Water	50	Lime Green	4
b. Oleic Acid or Talloil,		*d.* Ammonia (0.910)	4
Distilled	4	*e.* Alcohol	10

Mix *b* with *a*, work in *c* with good agitation; saponify with *d*. Let stand overnight. Keep covered.

Add *e*. Strain 6 hours later.[26]

FORMULA No. 27.

PROTECTIVE COATING FOR ALUMINUM AND OTHER METALS

Paraffin Wax	4	Flexo Wax C	2
Diglycol Stearate	1	(Amorphous Petroleum Wax)	
		Water	40

Heat together and mix with high speed agitator until uniform emulsion is formed.

Apply by spraying or brushing.[27]

24 Ibid.
25 Bennett, Chem. Formulary, Vol. 4, p. 412 (1939).
26 Ibid.
27 Ibid., Vol. 5, p. 335 (1941).

STOVE POLISHES

Formula No. 1.

Cumarone Resin	2	Water	200
Paraffin Wax, Soft	2	Nigrosin Base BB	10
Montan Wax, Crude	5-6	Lamp Black	24
Potash Carbonate	4	Graphite[1]	56

Formula No. 2.

Crude Montan Wax	2	Carnauba Wax	2
Rosin	1		

Heat to 90°C. with stirring and to it add slowly

Caustic Potash	2	Nigrosine	3
Water (Boiling)	86		

Keep on heat and agitate vigorously until uniform. Cool and work in

Graphite Flake	5	Lampblack	3

Mix thoroughly until uniform.[2]

Formula No. 3.

Paraffin Wax (40°-42°C.)	3.5	Graphite	24.0
Ozokerite, Crude	2.0	Ammonium Linoleate	4.0
Turpentine	40.0	Water	20.0
Rosin (D to K Grades)	0.7	Nigrosine, Oil-Soluble	0.8
Lamp Black	4.0	Potassium Carbonate[3]	1.0

Formula No. 4.

Rosin Oil	2	Caustic Potash	2
Montan Wax (Black)	2	Nigrosine	3
Carnauba Wax	2	Graphite	5
Water	82	Lampblack	3

The oil and waxes are carefully melted. The potash and nigrosine are dissolved in the water and gradually stirred into the wax mixture at 85° to 90°C. The resultant product

[1] Bennett, Chem. Formulary, Vol. 5, p. 531 (1941).
[2] Ibid., Vol. 4, p. 418 (1939).
[3] Ibid., Vol. 5, p. 531 (1941).

is agitated thoroughly during the cooling, when the graphite and lampblack are uniformly incorporated. The caustic potash forms a soap with the resin and aids emulsification and retards settling of the black.[4]

FORMULA NO. 5.

Stearic Acid	10 g.	Tetralin	10 g.
Spindle Oil	20 g.	Abrasive (Emery, Tripoli, Silicaceous Earth, etc.)	until pasty
Triethanolamine Linoleate	27 g.		
Water	13 g.		
Spindle Oil	20 g.		

Dissolve the fatty acids in the first spindle oil, mix with triethanolamine linoleate; add the second spindle oil, the tetralin, and ultimately the abrasive.[5]

FORMULA NO. 6.

a. Graphite	24	*b.* Hard Soap	3.2
Glycerin, Crude	5	Water	26
Formaldehyde	1	Paraffin	4

Prepare the solution *b* by boiling, and add to it the paste *a*. Stir till cold, and pour.[6]

FORMULA NO. 7.

a. Carnauba Wax	6	Diglycol Stearate	1
Montan Wax, Bleached	3	Potash Carbonate	1
Beeswax	3	Water	45
Rosin	1	*b.* Turpentine	40

Boil *a* until a homogeneous mass is formed.
Thin with *b*.[7]

FORMULA NO. 8.

a. Montan Wax, Crude	2.5	*c.* Potassium Carbonate	1.5
Rosin	0.8	Water	53.9
Japan Wax	0.7	*d.* Graphite	28.0
b. Nigrosin, Oil Soluble	0.6	Soot	12.0

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[4] P. C.
[5] Bennett, Chem. Formulary, Vol. 4, p. 416 (1939).
[6] P. C.
[7] Ibid., Vol. 4, p. 416 (1939).

Melt *a*. Dissolve *b* in the melted *a*.

Boil *c*, and stir in *d* to get a smooth suspension.

Mix *c* + *d* into *a* + *b* with good stirring. Put into cans while hot.[8]

FORMULA NO. 9.

a. Crude Montan Wax	2 lb.	*b*. Nigrosin, Water-Soluble	1 lb.
Carnauba Wax	2 lb.	Gra	20 lb.
Rosin	1 lb.		
Potash Carbonate	2 lb.		
Water	72 lb.		

Boil *a* until homogeneous. Stir in *b* gradually, until smooth.[9]

MISCELLANEOUS POLISHING EMULSIONS

FORMULA NO. 1.

TYPE "SIDOL"

Oleic Acid, Distilled	20	Neuburg Chalk	18
Alcohol	15	Kieselguhr	12
Heavy Benzine	15	White Bolus	
Ammonia (0.91)	12		

The oleic acid, dissolved in the solvent mixture, is saponified on the water-bath at temperature below the boiling point of the alcohol (60–70°C.). The strongly smelling liquid is now thickened with the abrasives which are added with good agitation.[1]

FORMULA NO. 2.

a. Neuburg Chalk	80.0	*b*. Oleic Acid	3.5
Kieselguhr	4.0	Ammonia (0.91)	1.0
Water	300.0	Alcohol	6.5
		Naphtha	10.0

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[8] P. C.

[9] Ibid., Vol. 4, p. 416 (1939).

[1] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

To the mixture *a*, made 24 hours earlier and left overnight, add *b*, which is made by saponification at gentle heat to a soft-soap-like mass.[2]

FORMULA No. 3.

Water	110	Turpentine	7½
Oxalic Acid	16	Neuburg Chalk	125
Oleic Acid	25	Water	215
Stearic Acid	4	Ammonia (0.91)	27½
Alcohol	15		

Dissolve the oxalic acid in ⅓ of the necessary water by heating to about 60°C. and add the remainder of the water.

Melt up the fatty acids, turn out any flames, and add the solvents with stirring.

Add the oils to the water, with stirring, add the chalk, and ultimately saponify with the ammonia, until, after an initial thickening, the mass starts to go thin again.

Keep in kettle for 2 days, stirring intermittently.

If the mass still settles, add more oleic acid.[3]

FORMULA No. 4.

a. Olein, Distilled	9	*c.* Oxalic Acid	2
Steaic Acid	2	Water (50–60°C.)	70
Alcohol	10	*d.* Neuburg Chalk, Fine	25
b. Ammonia (0.91)	14		

Dissolve *a* by heating to about 50–60°C. on water bath, saponify with *b*, and add the solution *c*. The resulting liquid is mixed with *d* in a good mixer.[4]

FORMULA No. 5.

Oleic Acid	16	White Spirit	10
Ammonia	10	Oxalic Acid	3
Clay, Powdered	60	Water[5]	160
Alcohol	10		

[2] Ibid.

[3] Ibid.

[4] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[5] Ibid.

FORMULA No. 6.

Oleic Acid	18	Ammonia	6
White Spirit	150	Alcohol [6]	4
Clay, Powdered	56		

FORMULA No. 7.

Spindle Oil	4	Ozokerite	4
Oleic Acid	10	Clay	15
White Spirit	3	Ammonia [7]	½

FORMULA No. 8.

a. Ammonium Oleate	2.1	*c.* Ammonia (0.91)	0.5
Water	19.5	*d.* Alcohol	2.1
b. Stearic Acid	1.0	*e.* Neuburg Chalk [8]	6.0

Heat *a* to almost a boil to dissolve; add *b* with good stirring, cool to 75°C., and saponify with *c*. Cool to 50°C., add *d* and work in *e* with very thorough mixing.

FORMULA No. 9.

Water	60	Silica or Tripoli	15
Bentonite	1	Mineral Oil [9]	18
Naphthenic Soap	6		

FORMULA No. 10.

Gray Carnauba Wax	25	Rosin	5
Japan Wax	5		

Melt and stir in

Turpentine Substitute	60

Strain and add

Solution of Potash (1%) [10]	5

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[6] Ibid.
[7] Ibid.
[8] Ibid.
[9] Ibid.
[10] P. C.

FORMULA No. 11.

a. Ammonium Linoleate		*c.* Graphite	20
Water	60	Lampblack	5
b. Water	5		
Potato Flour	2		

Make solution *a,* and separately paste *b.* Add *b* to *a,* mixing thoroughly. Work *c* slowly into this dispersion.[11]

FORMULA No. 12.

Carnauba Wax	4989	Diglycol Laurate	200
Solvent Naphtha	7000	Triethanolamine	450
Stearic Acid	1360	Water	29937
Nigrosin, Oil Soluble	907	Nigrosin, Water Soluble	453

Dissolve the water-soluble nigrosin in the water, add the triethanolamine, and, while hot, the stearic acid and diglycol laurate. Take up to a boil.

Add to this the solution of carnauba wax and the oil-soluble nigrosin in the naphtha, at 85–90°C. Stir until cold.

POLISH POWDER

Kerosene	20 fl. oz.	Mineral Oil, Light	10 fl. oz.
Silica (300 Mesh)	2 oz.	Sulfonated Castor Oil	4 fl. oz.
Infusorial Earth	1 lb.		

Mix the oils and powders separately and work the two components together. Four ounces of this mass are to be stirred into a quart of water for use. On standing, the water solution will settle out. Shaking will restore it to a usable state.[1]

FUR GLAZE

Add 10 parts of ammonium linoleate to 500 parts of water and to this mixture is added 50 parts of melted carnauba wax.[2]

[11] P. C.
[12] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).
[1] Crowley, Money Making Formulas.
[2] Bennett, Chem. Formulary, Vol. 2, p. 297 (1935).

NEATSFOOT OIL POLISH

Neatsfoot Oil (20° Cold Test)	50	Soap Chips	8
Lanolin Anhydrous	35	Water [3]	90
Japan Wax	20		

GLASS POLISH

1. Ammonium Linoleate	20	3. Water	200
2. Orthodichlorbenzol	100	4. Infusorial Earth	60

Dissolve (1) in (3) overnight and run (2) in while beating with high speed mixer. Then beat (4) in until uniform.[3a]

OIL POLISH

Mineral Oil	60	Triethanolamine	4
Naphtha	26	Methanol	4
Turpentine	3	Water [4]	120
Stearic Acid	9		

ABRASIVE POLISH

1. Carnauba Wax	42 lb.	6. Triethanolamine	8 oz.
2. Beeswax	18 lb.	7. Stearic Acid	2 lb.
3. Ceresin	18 lb.	8. Tripoli	24 lb.
4. Varnolene	3 gal.	9. Pumice	15 lb.
5. Water	3 gal.		

Melt 1, 2, 3, 7 with 4. Heat 5 and 6 to 90°C., add to wax mixture and stir till emulsified. Then add 8 and 9 and stir till cool.[5]

[3] Ibid., Vol. 1, p. 425 (1933).
[3a] Ibid., p. 424.
[4] Ibid., p. 427.
[5] P. C.

CHAPTER XVII

RESIN AND RUBBER EMULSIONS

ROSIN EMULSIONS

Formula No. 1.

Rosin	700	Glue	150
Water	2100		

Melt glue in water and while boiling hot, slowly add melted rosin, agitating violently. Continue agitation until perfectly smooth.[1]

Formula No. 2.

Rosin	700	Gelatin	150
Water	2100		

Melt gelatine in water and while boiling hot, add melted rosin slowly, agitating violently. Continue agitation until perfectly smooth.[2]

Formula No. 3.

Rosin	700	Stearic Acid	63
Water	2100	Triethanolamine	21

Melt rosin and stearic acid together. Add triethanolamine to water. Heat water to boiling point and stir in melted rosin. Stir until smooth.[3]

[1] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).
[2] Ibid.
[3] Ibid.

FORMULA No. 4.

Rosin	14	Water	84

Heat to boiling; turn off heat and add while stirring vigorously

Ammonium Hydroxide	5	Water	34

Stir until all lumps disappear (reheating may be necessary).[4]

FORMULA No. 5.

1. Rosin	100	4. Ammonium Hydroxide	
2. Naphtha	100	5. Water	200
3. Ammonium Linoleate	3		

Heat 1 to 150°C. and turn off flame; run 2 (which has been previously heated on a water-bath to 90°–100°C.) into it slowly and stirring until all rosin has dissolved; cool and add 3, 4, and 5 mixed together slowly with vigorous stirring.[5]

FORMULA No. 6.

Caustic Soda	lb.	Rosin	lb.
Water	100 lb.		

Boil together and stir until uniform.[6]

FORMULA No. 7.

ROSIN, TURPENTINE EMULSION

Rosin	11.0	Water	50.0
Turpentine	2.5	Ammonia	15.0
Ammonium Linoleate	2.0		

The ammonium linoleate and water are taken up in the usual way; heated, and mechanically agitated (high-speed mixer). The rosin and turpentine are heated together and added to the ammonium linoleate dispersion in water to

[4] Ibid.
[5] Ibid., Vol. 1, p. 443 (1933).
[6] P. C.

which has previously been added the 15 cc. of ammonia. Stirring is continued until cool.

This gives a paste emulsion.[7]

FORMULA No. 8.

RESIN EMULSION

Rosin, Ester Gum, Cumar, or Other Resin, (Melted)	3 lb.	Triethanolamine	2 oz.
		Casein Solution	2 lb.
Oleic Acid	1 oz.	Water, To make[8]	1 gal.

FORMULA No. 9.

PARAFFIN ROSIN EMULSIONS

In producing these dispersions, various proportions of paraffin and rosin may be used, for instance, from as high as 85% paraffin and as low as 15% rosin to as low as 15% paraffin and as high as 85% rosin. Assuming that a mixture of about 50% paraffin and about 50% rosin is employed, the mixture is melted and heated to about 220°F., which temperature is materially above the melting point of the paraffin (130°F.) and above the melting point of the rosin (about 180°F.). The heat-liquefied thermoplastic mixture is then commingled as a regulated stream flowing, say, at the rate of 15 pounds per minute with a regulated stream of 5% caustic soda solution at 110°F., flowing, say, at the rate of 20 pounds per minute. Under these conditions, an aqueous dispersion of a solids content of about 45% and at a temperature of about 155°F. is produced, which when suddenly chilled to a temperature below 130°F. to prevent coalescence of dispersed particles, is of a creamy consistency. In producing asphalt dispersions, at least about 35% rosin, based on the total weight of thermoplastic material, should be used in order to produce a stable dispersion of fine particle size.

[7] Ibid., Vol. 1, p. 163 (1933).
[8] Ibid., Vol. 2, p. 189 (1935).

Assuming that a mixture of about 50% asphalt having a melting point of about 150°F. and about 50% rosin is employed, the mixture should be heated to about 300°F., whereupon it is brought in contact with a caustic soda solution under practically the same conditions as in the case of the paraffin dispersion, except that the solution should be at 150° to 160°F. The resulting dispersion has a temperature of about 200°F., and when permitted to cool, is of a smooth, soft, paste-like consistency.[9]

Formula No. 10.

"CUMAR" EMULSION

Naphtha	20	Cumar	20

Heat above until dissolved; while at 90–100°C. add following solution (at 90–100°C.) slowly with vigorous stirring.

Ammonium Linoleate Paste	10	Water[10]	40

Formula No. 11.

GELVA RESIN EMULSION

Polyvinylacetate Resin (Gelva)	25.0	Water	39.4
Toluol	55.0	Sodium Lauryl Sulfate	0.2
Butyl Acetate	20.0	Sulfonated Castor Oil[11]	0.4

ETHYL CELLULOSE EMULSIONS

		Formula No. 12	No. 13	No. 14
1.	Ethyl Cellulose	5.0	5.0	5.0
	Octyl Acetate	63.0	5.0	5.0
	Toluol	63.0	63.0	63.0
	Diphenyl Oxide	0.6	1.4	1.0
	Dow Plasticizer No. 6	1.4	0.6	1.0
2.	Deceresol O T	2.0	2.0	2.0
	Water	13.0[12]	13.0[13]	

[9] Bennett, Chem. Formulary, Vol. 2, p. 189 (1935).
[10] Ibid., p. 188.
[11] Billing, U. S. 2,230,792 (1941).
[12] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[13] Ibid.
[14] Ibid.

Add 2 to 1 slowly while mixing vigorously with an electrical mixer.

METHYL METHACRYLATE EMULSIONS

Formula No. 15.

1. Monomeric Methacrylate	25	4. Water	64
2. Dibutyl Phthalate	5	5. Hydrogen Peroxide (30%)	3
3. Deceresol O. T. (10%)	4		

Mix 1 and 2 and add slowly to mixture of 3, 4, and 5, stirring well. Then pass through a colloid mill or homogenizer.[15]

Formula No. 16.

1. { Monomeric Methacrylate	12.5	3. Deceresol O. T. (10%)	4.0
{ Monomeric Styrene	12.5	4. Water	64.0
2. Dibutyl Phthalate	5.0	5. Hydrogen Peroxide[16]	2.0

Formula No. 17.

Methyl Methacrylate	30.0	Ammonium Persulphate	0.3
Water	100.0		

Heat to 80°C. and mix vigorously.[16]

NATURAL RESIN EMULSIONS

Formula No. 1.

Elemi	58	Oleic Acid	7
Batavia Dammar	14	Commercial Latex Solution	
Water	128	(About 36% Latex)	70
Triethanolamine	3		

Melt the elemi and stir in the dammar. Raise the temperature to 125°C. When the mixture is homogeneous, allow to cool and set the container into a boiling water bath. Add the oleic acid and then the triethanolamine with stirring. Add the water, pre-heated to boiling, portion by portion, stirring and incorporating after each small portion has been added

[15] Ibid.
[16] Ibid.
[16a] Ibid., p. 550.

before adding the next portion. The mixture thickens at first but as additions of water continue it changes to a thin white liquid. After all the water has been added, allow the mixture to cool but continue the stirring until it is cool. Add the latex solution with stirring.[17]

FORMULA NO. 2.

Manila DBB (Ground)	144	Commercial Latex Solution (About 36% Latex)	3690
Water	206		
Ammonium Hydroxide	60		

Mix the Manila, water and ammonia until all the resin dissolves. Strain. To this solution, add the latex solution.[18]

FORMULA NO. 3.

Manila DBB	144	Commercial Latex Solution (About 36% Latex)[19]	1230 lb.
Water	206		
Ammonium Hydroxide	60		

Mix the Manila, water and ammonia until all the resin dissolves. Strain. To this solution, add the latex solution.

CELLULOSE ESTER EMULSIONS

A pyroxylin base is prepared by colloiding 12.5 parts by weight of alcohol-wetted pyroxylin (10 parts of dry ½″ pyroxylin) with 20 parts by weight of blown linseed oil in a suitable mixer, such as the Werner and Pfleiderer mixer. 25 parts by weight of a solvent mixture are then added to the colloided mass in portions equalling 5 parts by weight to form a homogeneous base having the following composition:

Pyroxylin (½ sec.)	10	Butyl Acetate	20
Alcohol (Denatured)	2½	Butyl Lactate	5
Blown Linseed Oil	20		

[17] Amer. Gum Importers' Assn.
[18] Ibid.
[19] Ibid.

An emulsion is prepared by heating 0.5 part by weight of sodium oleate with 15 parts by weight of gasoline to a clear gel; after which 2 parts by weight of water are added to the hot gel with vigorous stirring, thus forming a concentrated emulsion of gasoline in water that is stabilized by sodium oleate. For convenience this will hereafter be called the agent emulsion.

The presolution or solvating of the sodium oleate in gasoline or some similar liquid is desirable to assure uniform distribution.

17.5 parts by weight of the agent emulsion are then stirred vigorously into 57.5 parts by weight of the pyroxylin base with a high speed stirrer of the propeller blade type.[20]

PHENOL-FORMALDEHYDE RESIN EMULSION

Phenol-Formaldehyde Resin	45	Sulphonated Sperm Oil	5
Paraffin Oil	5	Olein	5
(Heat together)		Cyclohexanol	1

Partially saponify above with aqueous caustic soda then add

Glue	2½	Water	45

Mix in homogenizer or colloid mill.[21]

POLYSTYRENE RESIN EMULSION

a.	Polystyrene Resin	7.5	b.	Emulsifying Agent (Deceresol O T)	1.0
	Toluol	22.5		Diglycol Laurate	0.5
	Octyl Acetate	6.5		Water	12.5
			c.	Toluol	50.0 g.

Dissolve *a;* to this add *b* slowly while mixing vigorously, then add *c* and stir until uniform.

This gives a stable film-forming emulsion.[22]

[20] U. S. 1,970,572.
[21] Ibid., Vol. 3, p. 109 (1936).
[22] Ibid., Vol. 5, p. 72 (1941).

"VINYLITE" EMULSIONS

One of the most satisfactory emulsifying agents is ammonium oleate, prepared "in situ" by adding oleic acid to the lacquer phase and an excess of ammonia to the water phase. Triisopropanolamine oleate prepared in a similar manner can be used if the volatility of ammonia is undesirable. Sodium lauryl sulfonate may also be used and this is dissolved entirely in the water phase. The amount of emulsifying agent required is of the order of 0.5 to 5 per cent of the weight of resin present, the exact amount varying for specific agents and specific types of emulsions.

A small amount (0.5 per cent of resin weight) of bentonite clay dispersed first in a little water and then added to the finished emulsion improves the stability upon storage appreciably. This should not be added to the water phase before emulsification, however. A ball mill is suggested as a suitable means of preparing the preliminary bentonite dispersion.

PLASTICIZED VINYLITE RESIN AYAA EMULSION

Vinyl Resin AYAA	50.0	Oleic Acid	1.5
Tricresyl Phosphate	5.0	Distilled Water	92.0
Toluene	43.5	Aqua Ammonia [23]	8.0

RUBBER EMULSIONS

Formula No. 1.

Rubber	70	Water [1]	10¾
Bentonite	1¼		

Formula No. 2.

Sodium Solution	7	Bentonite	20
Sodium Silicate	58	Water [2]	13

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[23] Carbide & Carbon Chemicals Corp., New York, N. Y. (Catalog).
[1, 2] U. S. 1,498,387.

FORMULA NO. 3.

A mixture of rubber 100, benzene 10–100, glue 1 and casein 1 part is masticated while slowly adding an aqueous solution of potassium oleate until the rubber constitutes the dispersed phase of the batch. The product is suitable for use as a cementing medium.[3]

ARTIFICIAL LATEX

Reclaimed Rubber	48.5	Rosin Soap	9.0
Cumar, Mineral Rubber or Gum Rosin	2.5	Whiting	40.0
		Water as desired.	

The reclaimed rubber and softener are mixed together in a Banbury mixer for approximately 20 minutes. The whiting and rosin soap are made into a stiff putty-like paste with water. This paste is then placed in a Werner-Pfleiderer mixer and the rubber-softener blend added gradually to the paste in the mixer. This process will require 30 to 80 minutes, during which time the mixer should be heated with steam passing through the jacket to a temperature of approximately 180°F. The mixing is continued until the rubber is completely dispersed in the form of fine particles 2–20 mu. in diameter. The dispersion thus made can be diluted as desired with water to reduce the viscosity. Bodying agents such as gum tragacanth and curing ingredients may be added with the water. This dispersion may be used to produce a rug backing material by spreading it on the back of the rug and evaporating the water.[4]

RUBBER RESIN EMULSION

1. Rubber Resin	40	3. Water	150
2. Ammonium Linoleate Paste	10		

[3] Bennett, Chem. Formulary, Vol. 1, p. 163 (1933).
[4] Ibid., Vol. 5, p. 543 (1941).

Heat 1 and 2 until homogeneous and add water to it slowly with vigorous mixing.[5]

FORMULA NO. 1.

CHLORINATED RUBBER EMULSIONS

Stable emulsions can easily be obtained without the use of emulsifying agents, if, for example, 70 g. of chlorinated rubber, 30 g. xylol and 40 g. of water—kept apart from each, *i.e.,* the chlorinated rubber is not dissolved but fed simultaneously and progressively into a stirring device in operation.[6]

FORMULA NO. 2.

Casein	2.0	Turkey Red Oil	6.0
Ammonia (28%)	0.1		

Heat to 35°C. with stirring and add slowly a solution of

Chlorinated Rubber	20	Trichlorethylene	80

Stir until uniform. This disperses well in water.[7]

CHLORINATED RUBBER EMULSION

20 parts, by weight, of oleic acid, saponified with 20 parts of sodium silicate in 200 parts of water, is stirred at 100°C. into 5 parts of chlorinated rubber dissolved in 25 parts resin oil; 125 parts of water containing casein 8 and ammonia 0.5 parts is then added.[8]

Chlorinated Rubber	100.0	Toluol	16.0
Hydrogenated Methyl		Xylol	110.0
Abietate	15.0	Water	98.5
Oleic Acid	4.9	Caustic Soda[9]	0.7

[5] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[6] Ibid., Vol. 4, p. 98 (1939).
[7] Ibid.
[8] Ibid., Vol. 3, p. 110 (1936).
[9] Billing, U. S. 2,230,792 (1941).

CHAPTER XVIII

TEXTILE EMULSIONS

TEXTILE SIZINGS

Formula No. 1.

Batavia Dammar A/D	10	Morpholine	1
Stearic Acid	10	Water	100

Melt the dammar and stearic acid. Keeping the temperature at 90°–95°C., stir in the morpholine and the water which has been preheated to 90°–95°C.[1]

Formula No. 2.

White Beef Tallow	30	Water	32–34
Sulfonated Tallow (50%)	30	Disinfectant or Deodorant	1–2
Japan Wax Emulsion	6–8		

Melt Japan wax and sulfonated tallow while agitating, when thoroughly melted add beef tallow and stir until thoroughly mixed. Then add water gradually and agitate until a full white creamy mix is secured.[2]

Formula No. 3.

Rosin	24–60	Sodium Silicate	5–10
Linseed Oil	24–60	Water[3]	500
Alkaline Casein Dispersion	8–10		

[1] Bennett, Chem. Formulary, Vol. 5, p. 591 (1941).
[2] P. C.
[3] Lefranc, U. S. 1,861,927 (1932).

FORMULA No. 4

Water	59.6	Oleic Acid	3.0
Beeswax	9.4	Caustic Soda	3.0
Japan Wax	11.0	Soluble Olive Oil [4]	3.0
Stearic Acid	11.0		

FORMULA No. 5.

Linseed Oil	100	Ammonium Linoleate	16
Trichlorethylene	100	Water [5]	100–200

FORMULA No. 6.

Paraffin Wax	40	Trigamine	3
Oleic Acid	5	Water	112

The Trigamine is dissolved in the water and the oleic acid is added, stirring thoroughly until completely homogeneous. This is then heated to 65–70°C. and the wax, previously melted, added with rapid agitation. Stirring is continued until the emulsion is cold.[6]

FORMULA No. 7.

Sulphonated Castor Oil (62% T.F.M.)	800	Caustic Soda Solution (27° Bé.)	350
Water	550	Silicate of Soda Solution (37° Bé.)	1300

Heat the sulphonated oil to 35–40°C. and slowly add the other ingredients in order given above, maintaining temperature above 35°C. until mixing is completed.[7]

FORMULA No. 8.

Melt together at a temperature of 50–60°C. equal parts of olein and dried phosphatides which have a soya bean oil content of 30% (and are obtained by extraction with 90 parts of benzol and 10 parts of 96% alcohol). Then by adding an

[4] Bennett, Chem. Formulary, Vol. 4, p. 529 (1939).
[5] Ibid., Vol. 1, p. 475 (1933).
[6] Ibid., Vol. 4, p. 553 (1939).
[7] Ibid., Vol. 3, p. 365 (1936).

equal quantity of water, keeping the temperature at 50–60°C. and adding small quantities of dilute soda lye, the mixture is emulsified under vigorous stirring. When required for use, this emulsion is diluted with further quantities of water in the desired manner.[8]

FORMULA No. 9.

Rosin	10–15	Stearin	7–20
Olein	2–10	Water	1000
Triethanolamine	7–20		

Sizing is done at 50°C. for 15 minutes. Then raise temperature to 60°C.

Desizing or washing is done with ½% soap solution at 60°C.[9] for one hour.

FORMULA No. 10.

Sulphonated Castor Oil (58%)	50 gal.	Caustic Soda Solution (27° Bé.)	12 gal.
Paraffin Oil (28° Bé.)	10 gal.	Water	23 gal.
		Steam Distilled Pine Oil	12 gal.

Mix ingredients in order named at 35–40°C., being careful to add caustic soda solution and pine oil very slowly, with constant stirring and allowing mixture to cool to room temperature as the pine oil is being added.[10]

ANTI-STATIC TEXTILE DRESSING

Magnesium Chloride (10% Solution)	Water	50

Filter and add to the following emulsion previously prepared:

Mineral Oil	80	Oleic Acid	7
Sulphonated Lauryl Alcohol	25	Water	50
Lauryl Alcohol	5		

[9] Bennett, Chem. Formulary, Vol. 2, p. 468 (1935).
[10] Ibid., Vol. 3, p. 365 (1936).

The above is used on cellulose acetate staple fiber to the extent of 1–4%.[1]

FUGITIVE TINTING DYE

1. Diglycol Laurate	98	3. Mineral Oil	1000
2. Fugitive Dye	2		

Dissolve 2 in 1 and then add 3. Goods marked with the above are washed out easily.[2]

KIER PENETRANT OIL

Xylol	10 gal.	Sulphonated Castor Oil	
Water	20 gal.	(62% T.F.M.)	20 gal.

Mix in xylol first and then water, with agitation, at 35–

LUSTER EMULSION FOR STARCHING

Stearic Acid	1 kg.	Water	4 kg.
White Beeswax	200 g.	Citronella Oil for Perfume	5 g.
Borax	60–75 g.		

Of this emulsion, 10 spoonfuls are used for 1 kg. of starch.[4]

ROT PROOFING EMULSION

1 Zinc Naphthenate	60.0	3 Emulsifying Agent	2.5
2 Mineral Spirits	17.5	4 Water	20.0

1 is dissolved in 2 and added slowly with vigorous mixing to 3 and 4 (mixed) and mixed until emulsified. The emulsion is diluted, as desired, with water before use.[5]

SCOURING ASSISTANT, TEXTILE

Dupanol L.S. Paste	15	Tetralin	70
Hexalin	2	Water[6]	10
Pine Oil	3		

[1] Ibid., Vol. 5, p. 595 (1941).
[2] Ibid., p. 598.
[3] Bennett, Chem. Formulary, Vol. 3, p. 365 (1936).
[4] Ibid., Vol. 5, p. 596 (1941).
[5] Ibid., p. 593.
[6] E. I. du Pont de Nemours & Co., Wilmington, Del.

DEGREASING EMULSION

Kerosene	60	Water[7]	35
Dupanol LS Paste	5		

SOAPY FULLING OIL

a. Oleic Acid	70	Carbon Tetrachloride	20
Methyl Cyclohexanol	5	*b.* Caustic Potash (50° Bé.)	

To *a* add enough *b* to just neutralize to phenolphthalein.[1]

TEXTILE SOFTENERS

Formula No. 1.

Water	7	Tallow[2]	
Soap	3		

Formula No. 2.

Tallow	100	Caustic Potash (45%)[3]	30

Formula No. 3.

Lecithin	5–10	Tetralin	500–1000
Cyclohexanol	50–100	Water[4]	1000

Formula No. 4.

Mineral Oil	10	Dupanol WS	2
Glue, Hide	10	Water[5]	78

TEXTILE GLOSS OIL

Formula No. 1.

Paraffin Wax	20	Water	70
Lanette Wax SX	10		

Heat together and stir until dispersed.[6]

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[7] Ibid.
[1] Bennett, Chem. Formulary, Vol. 4, p. 527 (1939).
[2] Ibid., p. 526.
[3] Ibid.
[4] Ibid.
[5] E. I. du Pont de Nemours & Co., Wilmington, Del.
[6] Bennett, Chem. Formulary, Vol. 2, p. 455 (1935).

FORMULA NO. 2.

Paraffin Wax	20	Glycosterin	10
Petrolatum White	2	Water	180

Heat together and stir until dispersed.[7]

FORMULA NO. 1.

YARN FINISH

Potash Carbonate	2	Montan Wax, Bleached, A	10
Rosin	7	Water[8]	65
Paraffin Wax, Soft	10		

FORMULA NO. 2.

Montan Wax, Double Bleached	8	Potassium Carbonate	2
Paraffin Wax (40/42°C.)	10	Water[8a]	60
Rosin	7		

"SOLUBLE" TEXTILE OILS

	FORMULA NO. 1	NO. 2
Mineral Oil (55 sec. Saybolt)	70	82
Oleic Acid	15	3
Sodium Petroleum Sulfonates	15	5
Lard Oil	..[1]	10[2]

FORMULA NO. 3.

Xylol or Toluol	15 gal.	Caustic Soda Solution	
Paraffin Oil (28° Bé.)	78 gal.	(27° Bé.)	1 gal.
Red Oil	2 gal.	Water	1 gal.
Alcohol	3 gal.		

Mix the paraffin oil and red oil, heat to 40°C., add the previously mixed water and caustic solution, then add the xylol slowly and the alcohol last and rapidly cooling them as quickly as possible after mixture is uniform.[3]

[7] Ibid.
[8] Ibid., Vol. 5, p. 596 (1941).
[8a] Ibid., Vol. 4, p. 188 (1939).
[1] Kinney, Can. 284, 807 (1928).
[2] Ibid.
[3] Bennett, Chem. Formulary, Vol. 3, p. 365 (1936).

FORMULA No. 4.

Water	2.0	Diethylene Glycol	2.0
Caustic Potash	1.2	Oleic Acid	9.9
Light Mineral Oil	85.0		

To the mineral oil add 6 parts of oleic acid, and the caustic potash dissolved in the water. Stir in the diethylene glycol. Then add slowly with constant stirring the remainder of the oleic acid, till the solution becomes clear. If properly made, this oil will emulsify when mixed with water.[4]

FORMULA No. 5.

a. Turkey Red Oil (50%)	30	*b.* Oleic Acid, White	15
Diglycol Laurate	1	*c.* Caustic Potash	To neutralize
Alcohol	1	Water, To make[5]	100
Methyl Glycol	1		

FORMULA No. 6.

An oil such as a mineral oil 64, is used in admixture with "Carbitol" 2, corn oil soap 14, rosin 10, water 6 and diethylene glycol 4%.[6]

FORMULA No. 7.

a. Oleic Acid	8.0	*b.* Alcohol	2.0
Colza Oil	4.0	Methyl Glycol	1.0
Rosin	2.0	*c.* Caustic Potash (50°)[7]	3.8
Castor Oil Fatty Acid	2.0		
Spindle Oil	32.0		

TEXTILE SCOURING EMULSION

Oleic Acid	10	Trigamine	3
Pine Oil	87	Water	100

Mix 30 grams of the pine oil with the trigamine, and oleic acid and stir thoroughly. Then add slowly 35 grams of water and stir till a smooth thick emulsion is formed.

[4] Ibid., Vol. 4, p. 188 (1939).
[5] Ibid.
[6] Ibid., Vol. 3, p. 365 (1936).
[7] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).

Then add the remainder of the oil with high speed agitation and finally the rest of the water.[8]

NON-SLIPPERY BELT AND ROPE PRESERVATIVE

Tallow	6	Soap	
Beeswax	1		

Melt together and add slowly with vigorous stirring.

Water (Boiling)	30

When emulsion is complete, dilute with water to a density of 0.950.[1]

SPINNING OIL FOR LIGHT OR WHITE FIBERS

White Oleic Acid	41	Caustic Potash (48° Bé.)	17½
Denatured Alcohol	31		

Mix these three thoroughly and test for neutrality. Make exactly neutral, then add

Water	11	White Oleic Acid[2]	35
White Mineral Oil	854		

ROPE PRESERVATIVE

Tallow	6	Water	30
Beeswax	1	Soap[3]	3

TEXTILE LUBRICANTS

FORMULA No. 1.

Olive Oil	87	Trigamine	3
Oleic Acid	10	Water[4]	100 cc.

FORMULA No. 2.

Oleic Acid	40.00	Water	60.00
Triethanolamine	2.04		

[8] Ibid., p. 499.
[1] Ibid., Vol. 5, p. 593 (1941).
[2] Ibid., Vol. 4, p. 188 (1939).
[3] Pfahl. Brit., 488, 643 (1938).
[4] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).

Stir together at about 35°C.,[6] and transfer immediately into a homogenizer, where the emulsion is homogenized under about 150 atmospheres pressure.[5]

FORMULA No. 3.

Monoamylamine Oleate	4	Mix the above and stir into	
Paraffin Oil (28° Bé.)	96	Water [6]	100

FORMULA No. 4.

a. Rosin WW	6.4	*c.* Spindle Oil	73.4
Mineral Oil	20.0	*d.* Alcohol	5.4
b. Olein, Light	10.5	*e.* Caustic Soda (40° Bé.)	2.2

Melt up *a* with agitation, until clear. Add *b*, *c*, cool down to 45°C., add *d*, and, with vigorous mixing, *e* in small portions, until the cloudiness disappears.

If it does not go clear completely, add some olein with caution.[7]

OIL COATING FOR GLASS FIBERS

Bright Stock (Petroleum) Oil	20 –40 %	Ammonia (28°)	4 %
Oleic Acid	12.6–18.5%	Water [8]	To make 100 %

ACETATE RAYON OIL

Sulphonated Castor Oil (65%)	50 gal.	Acetic Acid (28%)	20 gal
Commercial Olive Oil	45 gal.	Paraffin Oil (28° Bé.)	5 gal
		Water	100 gal

Manipulation: Mix the three oils and the water at 40°C. Then cool to 30°C., and stir acetic acid into mixture slowly.[9]

WATER PROOFING (ACETATE) RAYON

Paraffin Wax	5 g.	Ammonium Hydroxide (0.880)	30 cc.
Soap	5 g.	Water	970 cc.

[5] Ibid.
[6] Ibid.
[7] Ibid.
[8] Ibid., p. 215.
[9] Ibid., Vol. 3, p. 364 (1936).

Heat to 55°C. and stir vigorously until a uniform emulsion results. Soap the rayon in this emulsion at 45°C. for 15 minutes; remove; centrifuge and treat for 10 minutes at 20°C. with a 5°Tw. solution of aluminum acetate.[10]

RAYON DELUSTERING

Olive Oil Soap (Low Titre)	10	Water	100
White Glue	10		

Dissolve by warming and stirring; add Paraffin Wax. Heat and stir till emulsified.

Take 2½ parts of above emulsion and add to it

Water	100

Stir and add

Infusorial Earth[11]	2.27–4.54

[10] Ibid., Vol. 2, p. 468 (1935).
[11] Bennett, Chem. Formulary, Vol. 2, p. 468 (1935).

CHAPTER XIX

WATERPROOFING EMULSIONS

TEXTILE WATERPROOFING EMULSIONS

Formula No. 1.

A

Soap	10.0	Water	23.0
Water	20.0	Paraffin Wax	20.0
Gelatin	5.5		

B

Aluminum Sulfate	8.0	Water	2.0
Water	20.0	Formaldehyde	0.2
Soda Ash	0.5		

Emulsified Mixture A & B	30.0	Titanium Dioxide	5.0
Tapioca	7.0	Water	5.0
Water	50.0	Benzoic Acid [1]	2.0

Formula No. 2.

Cumar	4	Triethanolamine	2½
Carnauba Wax	15	Water [2]	185
Trihydroxyethylamine Stearate	7½		

Formula No. 3.

Ethylene Dichloride	40	Caustic Soda (50%)	3
Naphtha	40	Glycerin [3]	25
Diglycol Oleate	15		

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[1] Scholler, H. S., 2, 230, 656 (1941).
[2] P.C.
[3] P.C.

FORMULA No. 4.

Ethyl Cellulose	16.6	Naphtha	8.0
Hydrogenated Methyl Abietate	3.4	Water	1500.0
Toluol	56.0	Sodium Lauryl Sulfate	7.5
Butanol	16.0	Sulfonated Castor Oil [4]	15.0

FORMULA No. 5.

Japan Wax	80.6	Caustic Soda (10% sol.)	5.7
Paraffin Wax	9.0	Perfume [5]	To suit
Duponol WA Paste	5.7		

FORMULA No. 6.

Japan Wax	17½	Mineral Oil	40
Tallow Oil	17½	Carbitol	3
Diglycol Laurate	15	Diglycol Laurate	12
Water	50	Water [6]	45

FORMULA No. 7.

Paraffin Wax	2	Borax	3
Carnauba Wax	2	Water [7]	30
Triethanolamine Linoleate	10		

FORMULA No. 8.

Paraffin Wax	10	Ammonium Stearate (Paste)	20
Mineral Oil	50	Water [8]	70

FORMULA No. 8a.

Hard Paraffin Wax	50	Lanolin, Anhydrous	60
Petrolatum, Yellow	400	Rosin, Pale	40
Peanut Oil	200	Water	140
Beeswax, Yellow	100	Borax [8a]	10

FORMULA No. 8b.

Paraffin Wax	15	Water	70
Resin RH 35	15	Preservative (Moldex) [8b]	1/10
Gum Arabic	5		

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[4] Billing, U. S., 2, 230, 792 (1941).
[5] E. I. du Pont de Nemours & Co., Wilmington, Del.
[6] P.C.
[7] P.C.
[8] P.C.
[8a] P.C.
[8b] P.C.

WATERPROOFING FOR LEATHER

Gasoline	100 cc.	Rubber Latex	100 cc.
Paraffin Wax	25 g.	Soap (10% Solution)[9]	50 cc.
Paraffin Oil	10 g.		

STUCCO WATERPROOFING

Sodium Stearate	5 lb.	Water	95 lb.

Warm to 50°C. and stir till uniform, then add

Suet	2 lb.	Cresol Emulsion[10]	

[9] Bradley, U. S. 1,860,651 (1932).
[10] Bennett, Chem. Formulary, Vol. 3, p. 239 (1936).

CHAPTER XX

WAX EMULSIONS

BENTONITE WAX EMULSIONS

MAKE a 5% suspension of bentonite, that is, 95% water and 5% bentonite. The easiest way to do this is to put all the water to be used in a vessel and sprinkle a little of the bentonite on the surface. Allow to stand about three minutes or until the bentonite sinks to the bottom. Repeat. Don't stir or agitate. Allow to stand for at least four hours, then stir or agitate.

Heat the wax to fluidity. Heat the bentonite dispersion to the same temperature or slightly higher. Pour the wax into the water and stir. Stirring should be particularly vigorous at the point where the wax begins to solidify. A mechanical agitator is the best. In the laboratory use an electric soda-fountain stirrer.

The final mixture may be between 20% to 50% wax. However, it is best not to use over 40% wax, otherwise the emulsion will be too viscous.

The pH of bentonite in water is 7.5–7.8. In most emulsions a slightly higher pH is desirable, for instance, about 8.5. It would be well to adjust the water dispersion to the higher pH by very slight additions of alkali. Calcium oxide, calcium hydroxide, caustic calcined magnesite, magnesium oxide are recommended.

In some cases it will be found that a thicker dispersion of bentonite and water is desirable. This can be accomplished by using 6% bentonite or by adding very small percentages of other ingredients to the 5% dispersion. These other ingredients should be added *after* the dispersion is made. They will combine the advantages of thickening the dispersion and at the same time raising the pH. Add minute quantities and stir, using just enough to thicken the gel.

In relation to the quantity of bentonite in the dispersion, proper proportions would be as follows:

Calcium Oxide	3%	Caustic Calcined Magnesite	½ to 1%
Calcium Hydroxide	3%		
Chloride of Lime	2%	Magnesium Oxide	½ to 1%

For instance, with 95 cubic centimeters of water and 5 grams of bentonite, you would use 15/100 of a gram of calcium oxide, that is 150 milligrams. The magnesia compounds react more slowly. The others mentioned, react practically immediately.[1]

CANDELILLA WAX EMULSIONS

a. Candelilla Wax	30	*b.* Borax	2½
Triethanolamine	7	Water	20
Red Oil	5	*c.* Water [2]	150

Formula No. 2.

a. Candelilla Wax	20	Oleic Acid	

Heat to 95–100°C. and then run in the following heated to 95–100°C., mixing with a high-speed stirrer:

b. Triethanolamine		Water [3]	185
Borax			

Formula No. 3.

a. Candelilla Wax	20	Oleic Acid	

[1] Bennett, Chem. Formulary, Vol. 2, p. 182 (1933).
[2] Ibid., Vol. 4, p. 96 (1939).
[3] P. C.

Use above method adding:

b. Triethanolamine	3	Water[8a]	185
Borax	1½		

Formula No. 4.

Candelilla Wax	23	Water	232
Ammonium Linoleate S	3	Ammonia	2

Melt wax at 100°C. The ammonium linoleate is thinned by working in 30 cc. of water, a little at a time. The balance of water is heated to 95–100°C., and the ammonium linoleate solution is added to it. The whole is boiled and added, a little at a time, while stirring vigorously. Finally add the ammonia and stir until cooled to 50°C.[4]

CARNAUBA WAX EMULSIONS

Formula No. 1.

Carnauba Wax	260.00	Borax	11.11
Trihydroxyethylamine		Caustic Soda (50%)	2.22
Oleate	48.50	Water[5]	650.22
Triethanolamine	28.00		

Formula No. 2.

Carnauba Wax	16.0 g.	Ammonium Linoleate	2.4 g.
Kerosene	20.0 cc.	Water	200.0 cc.

The ammonium linoleate is placed in a vessel and covered with the water (cold) and allowed to stand overnight. The following day it is warmed and stirred until completely dispersed in the water, taking care that no lumps are left. This is taken to 90°C. and stirred by means of a high speed mixer. The wax is melted, taken to 100°C., and the kerosene added and stirred until the wax has dissolved in it. This is then added to the hot ammonium linoleate dis-

[8a] P. C.
[4] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[5] Ibid.

persion and the agitation continued until the emulsion is cool. This gives a fluid emulsion.[6]

FORMULA No. 3.

Mineral Oil (Spindle)	19 cc.	Ammonium Linoleate	2.4 g.
Carnauba Wax	18 g.	Water [7]	102 cc.

FORMULA No. 4.

Hydromalin	138	Carnauba Wax No. 1 or No. 2 Yellow	250

Heat to 120°C.–140°C. half an hour.
Cool to 100°C.–105°C.
Add to the above slowly with stirring.

Water (at 100°C.)	280

Stir to smooth paste then add slowly with good stirring.

Water (at 100°C.)	1500

Keep as close to 100° as possible for 15 minutes with rapid stirring. Then stir till cool.[8]

FORMULA No. 5.

a. Carnauba Wax	90 g.	*b.* Caustic Soda (50%)	6 g.
Oleic Acid	10 g.	Water	24 g.
Trigamine	10 g.		

a is melted. *b* is mixed together and heated. It is added to *a* slowly with stirring and the whole stirred until it begins to solidify. One part of the above disperses easily in five parts of boiling water.[9]

FORMULA No. 6.

Carnauba Wax	20.0	Borax	1.0
Duponol WA Paste	8.0	Water	71.0

[6] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[7] Ibid.
[8] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[9] Ibid., Vol. 4, p. 475 (1939).

Melt the carnauba wax in a steam bath and pour it into the DUPONOL WA Paste and borax dissolved in the water at approximately 95°C. Stir vigorously until a smooth emulsion is formed. Then stir gently until the emulsion has cooled to room temperature. A variation of this procedure is to add the DUPONOL WA Paste to the wax which has been melted in a steam bath and then to add the borax, dissolved in the water. Do not stir vigorously until cool.[10]

FORMULA No. 7.

Carnauba Wax	30.0	Gelatin	0.30 to 1.3
Oleic Acid	3.3	Shellac Solution consists of	
Caustic Soda	0.5	Refined Wax Free Shellac	1.5
Triethanolamine	2.7	Borax	0.38
Shellac Solution	62.0	Water[11]	8.33
Water	260.0		

CARNAUBA WAX-RESIN EMULSIONS

	FORMULA No. 1	No. 2	No. 3	No. 4	No. 5
Carnauba Wax No. 1	45	45	30	30	30
Gum Dammar A	15	15	30	30	30
Manila Gum DBB	5	5	..	..	..
Caustic Soda	1	1.5	0.9	2	2
Water	420	420	422	422	422
Triethanolamine	4	4	..	..	..
Trigamine	..	..	9.9	9.5	19
Oleic Acid	9	9	7	7	14
Stearic Acid	..	..	..	..	..
"Run" Boea (Hard Bold Amber)	..	..	..	..	..
"Run" Congo	..	..	..	..	..
	Film-Dull Slight Rubbing Gives Good Gloss	Film Same as No. 1	Film Same as No. 1	Film Same as No. 1	Film Same as No. 1

[10] E. I. du Pont de Nemours & Co., Wilmington, Del.
[11] Steinle, U. S. 2,275,659 (1942)

Formula

	No. 6	No. 7	No. 8	No. 9	No. 10
Carnauba Wax No. 1	33.5	47	47	30	30
Gum Dammar A	26.5	13	13	..	..
Manila Gum DBB	..	..	..	..	..
Caustic Soda	1.5	0.6	0.6	1	0.5
Water	420	420	420	420	420
Triethanolamine	2	4	4	4	4
Trigamine	..	..	..	..	..
Oleic Acid	4	..	9	9	9
Stearic Acid	..	9	..	..	..
"Run" Boea (Hard Bold Amber)	..	..	..	30	..
"Run" Congo	..	..	..	..	..
	Film Glossy	Film Glossy	Film Glossy	Film Glossy	Film Glossy

The procedure used is to melt the wax and to incorporate in it the natural resin (at temperatures of 100°–150°C.). This mixture is permitted to solidify and then used as needed in making the emulsion. For this purpose, the resin-wax mixture is melted in a boiling water bath. The emulsifier is added, the oleic acid being first incorporated, followed by the triethanolamine or trigamine. The sodium hydroxide is dissolved in 25 parts of the water, the solution heated, and added at its boiling point. This sometimes causes a gel to form, which is the signal to add the remainder of the water at its boiling point. If a gel does not form, addition of the water is withheld for a few minutes to permit thorough mixing of all constituents. Nos. 1 and 2 are made slightly different in that the Manila resin is dissolved in the sodium hydroxide solution mentioned above and not in the wax.[10a]

CERESIN WAX EMULSION

1. Ceresin Wax	16	3. Water	80
2. Aminostearin	4		

Heat 1 and 2 to 85°C., and add slowly with vigorous mixing to the water at 90–100C.[11a]

[10a] Amer. Gum Importers' Ass'n.
[11a] Ibid., Vol. 5, p. 72 (1941).

ESPARTO WAX EMULSION

a. Esparto Wax	15	*b.* Borax	1¼
Triethanolamine	3	Water	10
Red Oil	1⅞	*c.* Water	32½

Heat *a* to 95–100°C. and mix well; run into *b* heated to 95–100°C., beating vigorously; when smooth gel is formed add *c* heated to 95–100°C. and beat vigorously until cool.[12]

HALOWAX EMULSIONS

Formula No. 1.

Water	3 lb.	Stearic Acid	53 g.
Halowax	1 lb.	Triethanolamine[13]	27 g.

Formula No. 2.

Water	3 lb.	Stearic Acid	108 g.
Halowax	3 lb.	Triethanolamine[14]	54 g.

Formula No. 3.

Water	3 lb.	Stearic Acid	108 g.
Halowax	13 oz.	Triethanolamine	54 g.
Halowax Oil No. 1000	3 oz.		

Melt the wax and stearic acid together and stir. Heat the water and triethanolamine until they start to boil. Add the wax to the water and stir with an electric stirrer and then run through the colloid mill. A good emulsion is obtained if it is cooled quickly after coming from the colloid mill.[15]

JAPAN WAX ("SOLUBLE")

a. Japan Wax	50	*b.* Trigamine
Stearic Acid	14	

[12] Ibid., Vol. 4, p. 96 (1939).
[13] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[14] Ibid.
[15] Ibid.

An emulsion is obtained by dispersing one part of above in eight parts of hot water.[16]

JAPAN WAX EMULSION

a. Japan Wax	36	*b.* Water, Boiling	360
Trihydroxyethylamine Stearate	4		

Warm *a* to 65°C. and add *b* to it slowly with vigorous stirring.[17]

SELF-EMULSIFYING LAUNDRY WAX

Japan Wax	80.6	Caustic Soda (10% Solution)	5.7
Paraffin Wax	9.0	Perfume	q.s.
Duponol WA Paste	4.7		

Mix the waxes, Duponol WA Paste, and caustic soda solution together in a steam jacketed vessel and stir until thoroughly homogeneous. Cease heating and stir occasionally until almost solid. Then pour into suitable molds to solidify.[18]

MONTAN WAX EMULSIONS

Formula No. 1.

Montan Wax	20	Oleic Acid	5

Heat to 100°C. and add the following heated to 95–100°C slowly with good mixing:

Triethanolamine		Water[1]	185
Borax			

Formula No. 2.

Montan Wax	60 g.	Bentonite (6.6% Dispersion)[2]	5 cc.
Creosote	40 cc.		
Water	100 cc.		

[16] Ibid., Vol. 4, p. 475 (1939).
[17] Ibid., p. 96.
[18] E. I. du Pont de Nemours & Co., Wilmington, Del.
[1] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[2] P. C.

FORMULA No. 3.

Bleached montan wax is fused together with an equal amount of a solid, wax-like polymerization product of ethylene oxide (softening point about 50°C.) obtained by allowing ethylene oxide to stand at about 10° below zero C. with about 1 per cent its weight of sodium oxide or by heating ethylene oxide with about 0.1 per cent of caustic soda solution to from 50° to 60°C., the melt then being heated in ten times its weight of water while stirring. An emulsion is obtained which after cooling becomes very viscous and which, if desired, may be further diluted with water while heating, without deflocculation of the wax, and may be employed as a polish. Instead of Montan wax, stearic acid, montanic acid, tallow, wool fat and similar substances may be emulsified in an analogous manner.[3]

FORMULA No. 4.

Montan Wax	160	Water	600
Ammonium Linoleate	40		

Dissolve the ammonium linoleate in the water and heat to 95–100°C.; pour the wax into this slowly while stirring vigorously. While still hot run through a colloid mill.[4]

"OPAL WAX" EMULSION

Add desired weight of wax to weighed portion of water (emulsions having 40% wax, 60% water form a thick cream. Higher proportions of wax will be solid on cooling). Heat the water to boiling and continue boiling until wax has completely melted and formed a homogeneous oil film on the surface of the water. Remove from hot plate and after boiling has ceased add NH_4OH while stirring until the melt has a slight but definite ammoniacal odor. Place

[3] Bennett, Chem. Formulary, Vol. 2, p. 175 (1935).
[4] Ibid., p. 182.

in a mechanical agitator which will give rapid and thorough stirring (e.g., for small lots the type of mixer used at soda fountains is entirely satisfactory) and continue this stirring until emulsion has cooled below 60°C. Slow cooling in the range from 85° to 70°C. is advantageous.

Any froth or foam which forms will break upon standing except in the case of the higher wax contents (30% and above), when it may be necessary to apply vacuum to break the foam completely.

In the case of the higher wax contents, only very slow cooling while stirring will prevent the formation of a few small granules of solid wax.[5]

FORMULA No. 2.

a. Opal Wax	15	*b*. Water	75
Aminostearin	5	Sulfatate (Wetting Agent)	5

Heat *a* to 100–105°C. and add to it slowly while mixing with high-speed mixer *b* heated to 95°C.[6]

OURICOURI WAX EMULSION

Ouricouri Wax	13.2	Borax	1.0
Diglycol Oleate	2.5	Water	80.0
Triethanolamine	2.2		

Melt wax and diglycol oleate at 80°C., and make solution of other ingredients at same temperature. Add latter to former slowly while mixing vigorously with electric stirrer.[7]

PARAFFIN WAX EMULSIONS

FORMULA No. 1.

a. Paraffin Wax		*c*. Trigamine	3
b. Stearic Acid		*d*. Water	80

[5] Bennett, Chem. Formulary, Vol. 2, p. 189 (1935).
[6] Ibid., Vol. 4, p. 96 (1939).
[7] Ibid., Vol. 5, p. 72 (1941).

Melt *a* and *b* at 65–70°C. and add *c* and *d* at same temperature, slowly, while mixing with a high-speed agitator.[8]

FORMULA No. 2.

Paraffin Wax	120 g.	Stearic Acid	12 g.

Melt together and while stirring vigorously add following heated to 55°C.

Ammonia (26° Bé.)	6 cc.	Water	182 cc.

Stir until uniform.[9]

FORMULA No. 3.

Glyceryl Monostearate	5	Water	150

Heat and stir vigorously until uniform. Pour into this slowly while stirring strongly:

Paraffin Wax (melted)[10]	40

FORMULA No. 4.

Paraffin Wax	25	Glycol Stearate	5

Melt together and while stirring vigorously add

Water (boiling)[11]	175

FORMULA No. 5.

Mix 33 parts of paraffin wax with 3 parts of oleine, and pour this mixture into a solution of 0.6 part of strong ammonia in 63.4 parts of water, heated to 160°F.[12]

PARAFFIN WAX ("SOLUBLE")

FORMULA No. 1.

a. Paraffin Wax	50	*b.* Trigamine	7
Stearic Acid	14		

[8] Ibid., Vol. 4, p. 96 (1939).
[9] Bennett, Chem. Formulary, Vol. 3, p. 108 (1936).
[10] Ibid.
[11] Ibid.
[12] Ibid.

Melt *a* to about 70°C. Turn off the heat and add *b* stirring thoroughly. Continue stirring till it begins to solidify. One part of the above disperses easily in two parts of hot water.[13]

FORMULA No. 2.

Paraffin Wax	77	Duponol WS[14]	23

[13] Ibid., Vol. 4, p. 475 (1939).
[14] E. I. du Pont de Nemours & Co., Wilmington, Del.

CHAPTER XXI

MISCELLANEOUS

NON-AQUEOUS EMULSION

Wool Grease	20	Methyl Acetone	50
Benzol	50	Alcohol[1]	25
Balata Solution (1 lb. to 1 gal.)	50		

HIGH TEMPERATURE STABLE NON-AQUEOUS EMULSIONS

Formula	No. 1	No. 2	Formula	No. 1	No. 2
Mineral Oil	40	40	Polyglycerol Soya Bean Ester	..	5
Calcium Glyceryl Stearate	5	..	Glycerin	60	60

Heat to 200°C. and keep stirring while heating.[2]

SAFETY-PAPER INK

An emulsion of a suitable printing ink consistency comprises Canadian balsam 8–20, turpentine 5–17, finely divided substantially colorless mineral matter such as diatomaceous silica 8–25 and castor oil 12–30%, emulsified with a slightly alkaline solution of borax and contains a substantially colorless indicator such as phenolphthalein reactive to both acids and alkalies, so that it is suitable for "safety paper" for checks, etc.[3]

[1] Simon, U. S. 1,657,323 (1928).
[2] P. C.
[3] Bennett, Chem. Formulary, Vol. 4, p. 147 (1939).

NON-FOAMING OIL EMULSION

Stearic Acid		Mineral Oil	500 g.
Oil-Soluble Mahogany Sulphonate	99 g.	Water	5000 cc.

Warm and mix first three ingredients until clear; then add water slowly with vigorous mixing.[4]

PETROLEUM DEMULSIFIERS

FORMULA NO. 1.

Diglycol Laurate	83	Phenol	4
Sodium Silicate	5	Water	1½
Rosin Soap	5	Paraffin Wax [1]	1½

FORMULA NO. 2.

5% of a solution of the following is agitated with the emulsion and then allowed to settle:

Naphthenic Acid Salt	¼	Water [2]	99½

FORMULA NO. 3.

Furfuraldehyde-Potassium Bisulphite Solution	11.1	Ammonia (0.897)	8.9
Ricinoleic Acid	50.4	Castor Oil [3]	29.6

FORMULA NO. 4.

The oil is mixed in continuous phase with

Caustic Soda	25	Glycerin	10
Sodium Acetate	10	Water [4]	35–45
Alcohol	20		

[4] U. S. 2,052,164.
[1] Bennett, Chem. Formulary, Vol. 3, p. 114 (1936).
[2] Ibid., Vol. 4, p. 100 (1939).
[3] Ibid., p. 99.
[4] Ibid.

CHAPTER XXII

DISPERSIONS

DISPERSING INSOLUBLE POWDERS

INSOLUBLE powders such as zinc oxide, sulphur, Neozone D, Zenite, dry powder colors and fillers are dispersed by grinding in water with a protective colloid and a dispersing agent. The presence of a small amount of fixed alkali in such a mixture is desirable.

Insoluble Powder	100.00	Sodium Hydroxide	0.10
Casein	3.00	Water	95.65
Preservative "Moldex"	0.25		
"Darvan" (Dispersing Agent)	1.00		

Heat the water to 175°F. and add 1 part of 29% aqua ammonia. Add slowly with rapid stirring 3 parts of casein and continue stirring until it is dissolved. Then add 0.1 part of sodium hydroxide. Next 0.25% of a preservative should be added. Darvan (1.0 part) is readily soluble in water and may be added to the solution alone or with the insoluble powders, 100 parts of which are next added. The mixture is then placed in a pebble mill having a capacity double the volume of the mixture and ground for about 24 hours or ground in a colloid mill for a suitable length of time. If dry color pigments are being dispersed, it is desirable to double the grinding time.[1]

[1] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).

CARBON BLACK DISPERSION

Carbon Black	100	Water	563 to 599
"Darvan"	4 to 8		

If a thicker dispersion than results from the above is desired, it may be obtained by adding during the last hour of grinding 1 to 2 parts of casein in water solution.

The method used is similar to that for suspending insoluble powders.[2]

CARBON BLACK DISPERSANT

Quebracho Powder (Finely Ground)	95.0	Soda Ash	5.0
		Phenol	0.2

Mix and grind in a pebble mill.[3]

DISPERSING AGENTS

Formula No. 1.

Tallow	175	Dimethyl Amine (25%)	324

Heat at 200°C. in an autoclave for 16 hours. This yields a mixture of dimethyl amides.[4]

Formula No. 2.

Lauryl Alcohol, Melted	186	Chlorsulphonic Acid	116

Stir while heating gently.

After removing the hydrogen chloride by passing through the reaction mixture current of inert gas, add

Triethanolamine[5]	150

Formula No. 3.

325 kilograms of octadecenylamine are sulphonated at 25°C. with 400 kilograms of concentrated sulphuric acid. After the product has become water-soluble, it is pressed

[2] Ibid.
[3] Ibid.
[4] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[5] Ibid.

on to ice, washed with saturated Glauber's salt solution in order to remove the excess of sulphuric acid and finally neutralized with caustic soda solution.[6]

FORMULA No. 4.

Sulfonated Castor Oil	35	Water	30
Steam Distilled Pine Oil	35		

Heat the castor or red oil, agitate while adding the pine oil until thoroughly blended, add water—then adding a 25% solution of caustic soda solution with stirring until the solution becomes clear. Test 10 cc. in 50 or 100 cc. of cold water should dissolve instantly and no separation should occur.[7]

FORMULA No. 5.

Water	50	Sulf. Castor Oil (75%) or Red Oil	6–8
Caustic Soda	16	Cresylic Acid	25–32

Add caustic to water then castor or red oil is added while being stirred until solution clears. Cresylic is best added before oil.[8]

FORMULA No. 6.

Octyl alcohol is used in the following proportions by volume:

(a) Pigments in water or oil base paints, use 0.02–1.0% of weight of pigment.
(b) Pigments in water base cosmetic lotions, use 0.001–0.01%.
(c) Pottery casting clays to increase "slip" and remove air bubbles, use, 0.0001–0.001% of "slip".
(d) Leather dressings, spray 0.002–0.02% onto pigment before water is added.
(e) Pigments in lacquers, use 0.1–1.0% of weight of pigment.
(f) Mercerizing baths.
(g) Penetrating oils, use approximately 1.0%.[9]

[6] Ibid., Vol. 2, p. 184 (1935).
[7] P. C.
[8] P. C.
[9] P. C.

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